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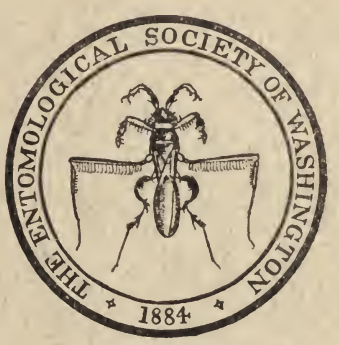
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PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 40 JANUARY, 1938 No. 1

HAEMAGOGUS TROPICALIS, A NEW SPECIES FROM PARÁ, BRAZIL (DIPTERA, CULICIDAE).[1]

By N. CERQUEIRA AND P. C. A. ANTUNES.

In studying material collected in connection with the investigation of possible vectors of jungle yellow fever, a new species of the genus *Haemagogus* was found. The species is described below.

Haemagogus tropicalis, n. sp.

Male.—Proboscis dark brown with blue reflection, curved, long and slender. Palpi dark blue with violet reflection, long, about two-thirds the length of proboscis (Fig. 17). Antennae plumose, about as long as the palpi. Clypeus dark, shining, nude. Occiput clothed with metallic blue scales with green reflection; a small spot of silvery-white scales at vertex; some scales of this color along the margins of the eyes; others at the sides below, producing an inconspicuous silvery-white spot.

Prothoracic lobes clothed with metallic blue scales, darker than those of the occiput; no white scales; dark bristles along the anterior margin.

Mesonotum.—Integument black, covered with flat ovate metallic blue scales with green and coppery reflection. Scutellum clothed with broad flat metallic blue scales with green reflection. Pleurae and coxae blackish, clothed with flat silvery-white scales; the scaling on sterno-pleurae extends up to the border of mesonotum, beyond the root of wings.

Abdomen covered with metallic blue scales with violet reflection. Dorsally, from third to seventh segment, small median basal white spots, formed by broad silvery-white scales. Laterally, from first to seventh segment, conspicuous silvery-white spots; on the first and second segments these spots extend from anterior to posterior border of the tergites; on the following five segments they are basal and run to about half the length of the tergites. Venter violet-blue scaled, with narrow segmental basal silvery-white bands. Eighth sternite (Fig. 16) with stiff spine-like setae, some short, others long.

Legs violet-blue. Fore and mid femora with a small silvery-white spot on inner side; hind femur silvery-white on inner side from base to about two-thirds of its length. Fifth fore tarsal (Fig. 15) with a short spine at base, arising from conspicuous tubercle; two other tubercles, not so much developed, at the union

[1] The studies and observations on which this paper is based were conducted with the support and under the auspices of the Cooperative Yellow Fever Service maintained by the Brazilian Government and the International Health Division of The Rockefeller Foundation.

of proximal third with the distal two-thirds, bearing a short delicate spine each.

Wings dark, a little shorter than the abdomen; scales on costa, subcosta, and first vein have blue and violet reflection, chiefly on basal half.

Claw formulas.—1 /1.1 /1—1 /0.1 /0—0 /0.0 /0. On fore tarsals, both claws of both legs are toothed; mid tarsi on each leg have one claw toothed, the other simple. Hind tarsal claws simple.

Genitalia (Plate 3).—Side-piece conical, a little more than twice and a half as long as wide, with long setae all around, except at a long triangular area which occupies the whole length of internal surface. The basal half of this area has numerous short delicate bristles inserted in small tubercles. Basal lobe inconspicuous, well chitinized, bearing numerous long, narrow, flattened setae. The outer surface of side-piece, chiefly on basal half, has numerous long spatulate scales. Along the internal border, on upper two-thirds, a row of scales of different shapes and lengths; some are long, narrow, lanceolate; others, about one-half to two-thirds the length of the preceding ones, broad, abruptly reduced at distal extremity to a short point; a third type is represented by broad and very short curved scales.

Clasper slender, short, a little less than one-half the length of side-piece, with a long terminal spine about one-half as long as itself. A few very short hairs on basal third of clasper; in a stained specimen, a stiff hair arising from a small tubercle is present on distal third of one clasper's branch.

Claspette (Fig. 14) with rather slender, long, curved stem, sparsely hairy on basal two-thirds, chiefly on inner side; a single seta at the union of upper distal third with basal two-thirds; one or two setae near base. Filament of claspette conspicuous, about three-fourths the length of stem, broad, leaflike, with a notch which divides it into two leaves; one of them is in the direction of stem; the other is sharply pointed, and forms an angle with the first one. Tenth sternite long (Fig. 13), strongly chitinized, rounded at apex; inner surface shows near tip a transverse patch (rows) of denticles. Two moderate stiff hairs on ninth sternite.

Mesosome (Fig. 12) broad, rounded at distal half, narrowing toward base, balloon-shaped in outline with a small point at apex; a median longitudinal line chitinized at distal half. Ninth tergite has no lobes; in some specimens there is a single curved seta on one side.

Female.—Coloration as in the male. Palpi short, about one-seventh the length of proboscis.

Claw formulas.—1 /1.1 /1—1 /1.1 /1—0 /0.0 /0. Fore and mid tarsal claws toothed; simple on hind tarsi.

Larva (Plate 1).—Head rounded. Antennae small, smooth, with shaft hair slightly beyond the middle. This hair is single in most of the specimens, but a few show a single hair in one side and a bifurcated one in the other side. Ante-antennal tuft with 4 to 6 elements. Lower head hairs double; somewhat closer than these to the median line, a pair of long delicate tufts. Upper head hairs long, single. Mental plate triangular, with a stout central tooth and 8 to 9 teeth on each side, the two basal ones remote and angular; the outer, sometimes small and very remote.

Skin glabrous. Lateral comb of eighth segment in a triangular patch of 24 to 28 scales in irregular rows. These scales are thorn-shaped, fringed at tip

and sides with short fine spinules (Fig. 5). Dorsal and ventrally to the comb, a tufted hair of 3 to 5 branches; posteriorly, a tuft of 6 to 9 elements arises from a circular chitinization; two single hairs flank this tuft, arising somewhat closer to the comb.

Air-tube a little less than twice and one half as long as wide. The pecten nearly reaches the middle, followed by a three-to-four-haired tuft; the number of teeth of pecten varies from 12 to 17, of which the 2 to 5 basals are rudimentary.

Anal segment slightly longer than wide, with rugose dorsal plate reaching well down the sides; posterior edge of the plate with very short denticulate spines (Fig. 7); dorsal tuft a long hair and a brush on each side; lateral tuft moderate, three-haired; ventral brush with one or two tufts preceding the barred area and a chitinized plate on each side.

Anal gills about the length of the segment, pointed, but not sharply, the lower pair shorter than the upper.

Discussion.

Two species of *Haemagogus* have been described, with long male palpi; *equinus* Theob., 1903, and *panarchys* Dyar, 1921; *tropicalis* is then the third.

As we have no specimens of *panarchys*, the distinction was made comparing our specimens with Dyar's descriptions and figure (1 and 2). The main difference we were able to see is in the morphology of the claspette, whose stem is notched on outer side and conspicuously hairy at tip in *panarchys;* this character cannot be seen in *tropicalis*.

We examined a male specimen of *equinus* (Miraflores, Panamá), from the collection of the Instituto Oswaldo Cruz, Rio de Janeiro, through the kindness of Dr. Costa Lima. This species was easily separated from *tropicalis* by the male genitalia. More recently we were very pleased to receive from Mr. W. H. W. Komp, Panamá, the dissected and stained male genitalia and the 8th sternite of a specimen of *equinus* from Summit, Canal Zone.

This paper is based on the examination of 41 females, 18 males, 7 larval skins, and 11 pupal cases. All collections were made from January to May, 1936, at Curralinho, Pará, Brazil, by Dr. H. W. Kumm and A. Rabello. Most of the trees where the breeding places have been found were not mentioned by the collectors; three of them were identified as *Euterpe cleracea* Mart., Palmae (Assahyseiro); *Carapa guyanensis* Aubl., Meliaceae (Andiróba); Tecoma sp., Bignoniaceae (Ipé).

The following are the places in Curralinho where the material was collected: Rio Camucú; Rio Cupijó; Rio Cupijó-mirim, Bôa Esperança; Rio Maracujá-mirim, Ponta Grande; Rio Massaranduba; Curralinho.

The chief differences between *equinus* and *tropicalis* are the following:

	equinus	*tropicalis*
Larva:		
Comb of eighth segment	A row	A patch
Lower head hairs	Single	Double
Male genitalia:		
Claspette	Stem stout, markedly swollen at apical half; filament as in fig. 14a.	Stem slender, not swollen; filament as in fig. 14.
Scaling of inner border	All scales of similar shape; narrow, lanceolate.	Scales of different shapes; some narrow, lanceolate; many are broad, pointed at apex; others are short, broad, crooked.
Abdomen:		
Vestiture of posterior border of 8th sternite in the male	A median group of strongly inserted narrow straight scales (fig. 16)	This group is formed by spinelike setae. (fig. 16).

Male holotype, female allotype, larval skin, and pupal cases to be deposited in the Instituto Oswaldo Cruz, Rio de Janeiro, Brazil.

Male and female paratypes to be deposited in the Laboratory of the Yellow Fever Service at Rio de Janeiro, Brazil; in the Section of Parasitology of the Instituto de Hygiene, São Paulo, Brazil; in the United States National Museum, Washington, D. C.; and in the Malaria Research Laboratory, Ancon, Canal Zone, Panamá.

Acknowledgments.

We are very much indebted to Dr. H. W. Kumm, who furnished us with the precious material, including living larvae, larval skins, and male and female adults from Curralinho, Pará, Brazil.

The writers are also very grateful to Dr. A. da Costa Lima and Mr. W. H. W. Komp for their invaluable advice and for their assistance in supplying us with specimens for comparison with our material here reported.

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2. Dyar H. G. 1928. The Mosquitoes of the Americas. Carnegie Inst. of Washington, Publ. No. 387, 616 pp.

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4. Howard, L. O., H. G. Dyar, and F. Knab. 1917. The Mosquitoes of North and Central America and the West Indies, IV : 871–875.
5. Theobald, F. V. 1903. Two New Jamaican Culicidae. The Entomologist, XXXVI, p. 282.

Explanation of Plates.

Plate I—*Haemagogus tropicalis*, n. sp. Fourth stage larva.
Fig. 1: Head, ventral view; number of hairs on groups *a*, *b* and *c*, varies as follows: a)—from 2 to 4; b)—from 2 to 4; c)—2 or 3.
Fig. 2: Head, dorsal view.
Fig. 3: Mental plate.
Fig. 4: Air tube; eighth and anal segments.
Fig. 5: A scale of pecten of eighth segment.
Fig. 6: A spine of pecten of air-tube.
Fig. 7: Spines of posterior margin of the plate of anal segment.

Plate 2—*Haemagogus tropicalis*, n. sp. Pupa.
Fig. 8: Cephalothorax
Fig. 9: Abdomen, male, dorsal view.
Fig. 10: Abdomen, female, dorsal view.

Plate 3—Male genitalia.
Fig. 11: *H. tropicalis*, n. sp., male genitalia.
Fig. 12: *H. tropicalis*, n. sp., mesosome.
Fig. 13: *H. tropicalis*, n. sp., tenth sternite.
Fig. 14: *H. tropicalis*, n. sp., claspette.
Fig. 14a: *H. equinus* Theob., claspette.

Plate 4.
Fig. 15: *H. tropicalis*, n. sp., fifth tarsal segment and claws of forelegs of the male.
Fig. 16: *H. tropicalis*, n. sp., eighth sternite, male.
Fig. 16a: *H. equinus*, Theob., eighth sternite, male.
Fig. 17: *H. tropicalis*, n. sp., male proboscis and palpus.

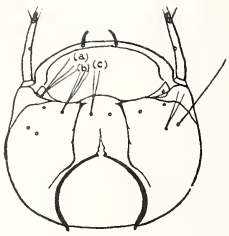


Fig. 1

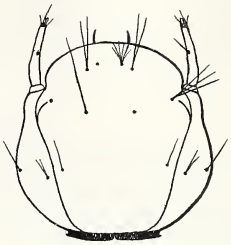


Fig. 2

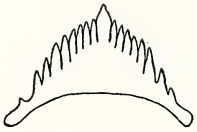


Fig. 3



Fig. 5

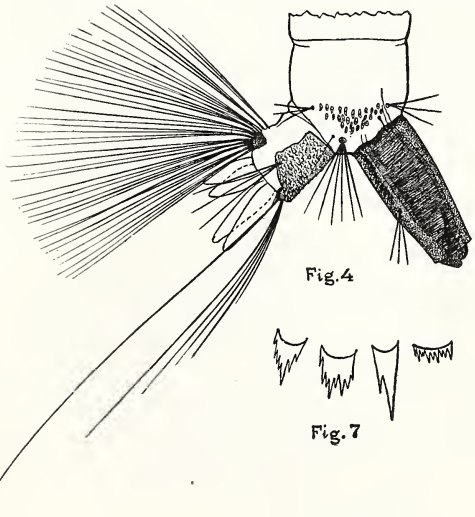


Fig. 4

Fig. 7



Fig. 6

N. Cerqueira, del.

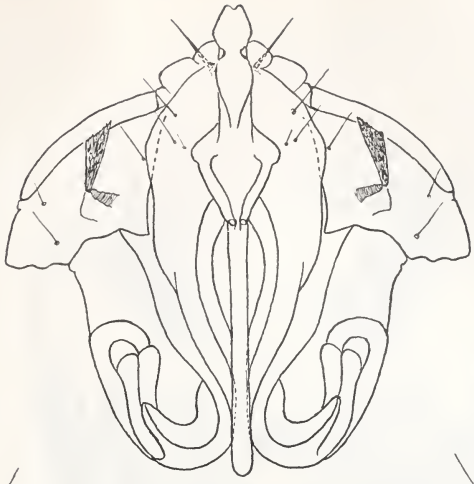


Fig. 8

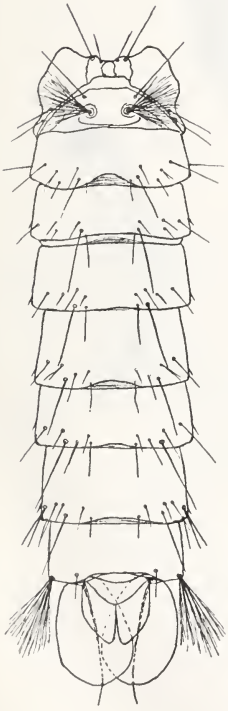


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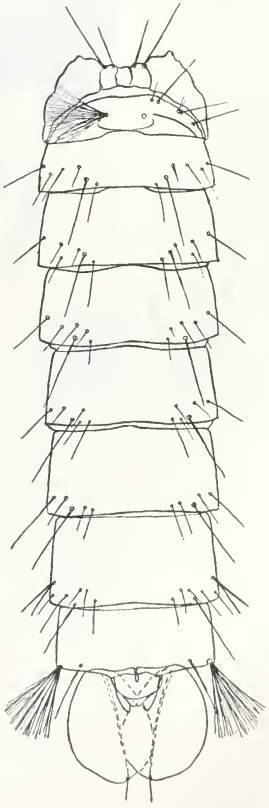


Fig. 10

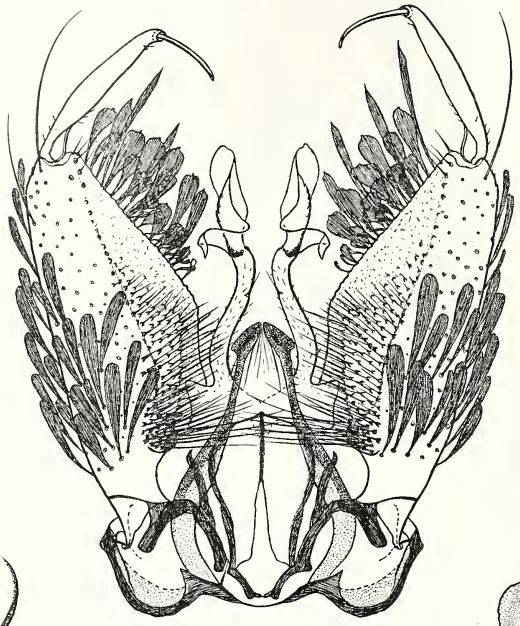


Fig. 11



Fig. 12

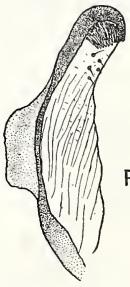


Fig. 13



Fig. 14

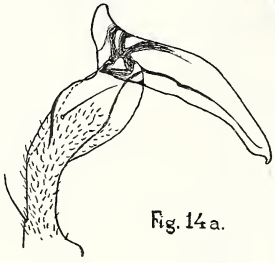


Fig. 14a.



Fig. 15

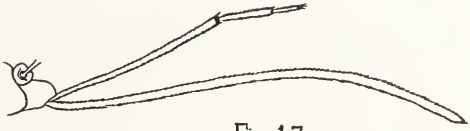


Fig. 17

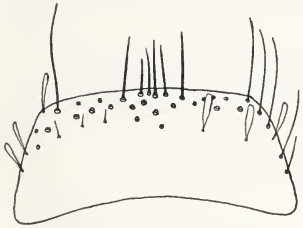


Fig. 16

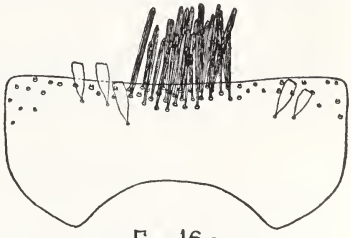


Fig. 16 a.

SOME NEW WESTERN NORTH CAROLINA MOSS-MITES.

By Arthur Paul Jacot,
Northeastern Forest Exp. Station, New Haven, Conn.

The following species and subspecies of Oribatidae were procured while making a census of the fauna of the litter of hardwood forests chiefly in the Bent Creek watershed, Buncombe County, in the mountains of North Carolina. The types are to be deposited at the United States National Museum.

Camisia segnis amicus, subsp. nov.

Differs from the species (9, p. 38, figs. 1A, 1B) in that notogastral bristles B1 (D2 of Grandjean) are on same transverse plane as B3 (D3), thus spacing B1, B2 and C1 (E1) subequally; middle bristle of parasterna I is close to center of plate instead of near posterior edge; pseudostigmatic organs are so short that only the head extends beyond lateral edge of pseudostigma; notogastral bristles F3 (Op2) extend at least to insertion of F2 (Op1), and bristles E3 (K1) are relatively much longer, bearing at least a dozen barbs.

Cotypes: Nine specimens from litter of thirty-year-old white pine plantation on Biltmore estate on Asheville-Brevard road, about eight miles from Asheville, N. Car.; taken October 8th, 1934, slide 34 F9.2–15.

Platynothrus bicarinatus, sp. nov.

As *P. peltifer* but the two mesal carina of notogaster absent; notogastral bristles much longer; animal larger: total length of body 0.67 mm., greatest breadth 0.37 mm.

Cotypes: Twenty-two specimens from litter of Poplar Cove, Bent Creek Exp. Forest, Buncombe Co., N. Car.; taken July 1st, 1935, slide 35F5.1–15.

Oribata tectopediosa, sp. nov.

Differs from all other species of the genus in having tectopedia II strongly and elaborately sculptured by deep, closely crowded pock-marks. There are also weak, angular areolations on the cephaloprothorax midway between interlamellar and lamellar bristles and down the sides to rostral bristles. Pseudostigmatic organs setaceous, distal end flagellate, with two bends (forming an open shepherd's crook). Anal and genital apertures well spaced; anterior end of anal covers strongly produced as a lobe; trochanters (coxae) I to III each with a long bristle. Total length of body of males 0.33 mm., of females 0.37 mm.

Cotypes: Twenty-five specimens from oak litter of ridge above Poplar Cove, Bent Creek Exp. Forest, Buncombe Co., N. Car.; taken July 15th, 1935, slide No. 35F6.3–17.

Oppia minus simplex, subsp. nov.

Differs from the species (12, p. 48, pl. 3, fig. 11) in the absence of the crescentic ridge anterior to interlamellar bristle spurs. I find twenty notogastral bristles. Paoli undoubtedly overlooked that on anterolateral edge of notogaster (directly posteriad of the pseudostigmata). The other two are at posterior end of abdomen. Length of types 0.18 to 0.19 mm.

Cotypes: Forty-two specimens from Andropogon sod of overgrazed pasture on Asheville-Brevard road, twelve miles from Asheville, N. Car.; taken October 23d, 1934, slide 34F11Op3.

Oppia elongata, sp. nov.

Notogastral bristles very fine; sculpturing of cephaloprothorax confined to basal portion; pseudostigmatic organs clavate, head fusiform, ciliate; tectopedia I developed as a conical lobe projecting laterad between insertions of legs I and II, not at all curved forward. This is the smallest tectopedia I I have yet seen in this genus and is immediately diagnostic. Interlamellar bristles short, fine, curved anteriad, distant from posterior edge of cephaloprothorax, in lateral aspect appearing to spring from distal end of a low ridge; total length of body 0.3 mm.

Cotypes: Ninety-seven specimens from litter of mixed hardwoods, Rocky Cove, Bent Creek Exp. Forest, Buncombe Co., N. Car.; taken September 8th, 1934, slide 34F1–14.

Oppia quadricarinata ferrumequina subsp. nov.

Differs from the species (11, p. 393, pl. 7; 11a, p. 385, pl. 31, figs. 13–15) in that notogastral ridge continues backward and mesad, joining to form a horseshoe.

Cotypes: Forty specimens from Liriodendron-Fraxinus litter of a south cove, Shut-in-Ridge, Bent Creek Exp. Forest, N. Car.; taken June 17th, 1935, slide 35F4.2–7.

Autogneta longilamellata amicus, subsp. nov.

Differs from the species (11, p. 391; 11a, p. 392, pl. 28, figs. 13–15) in that interlamellar bristle ridges are reduced to slender, straight bars lying along posterior edge of prothorax. Both Michael and Paoli figure the European form as having these ridges shaped like an ? point with the interlamellar bristle insertion included by the ridge.

Cotypes: Twenty-five specimens from fern litter (possibly *Adiantum pedatum*), Poplar Cove, Bent Creek Exp. Forest, Buncombe Co., N. Car.; taken July 1st, 1935, slide 35F5.3–9.

Eremobelba leporosus leporoides, subsp. nov.

Differs from the species (10, p. 225, pl. 15, fig. 6) from South and Central America, in that notogaster is much more slender, and its bristles are differently

arranged; and from *E. gracilior* (3 p. 10; 3a, pl. 21, fig. 74) from "North America" (probably Columbia, Mo., possibly from Lake City, Fla.) in position of notogastral bristles, the stout burred interlamellar bristles, and in the notogastral sculpturing which is granular-tuberculate arranged to form a net-pattern. Total length of body 0.37 mm., total breadth 0.18 mm., length of notogaster 0.24 mm.

Cotypes: Fifty-two specimens from Andropogon sod, top of Shut-in-Ridge, Bent Creek Exp. Forest, N. Car.; taken May 8th, 1935, slide 34F34–36.

Eremobelba leporosus flagellaris, subsp. nov.

Differs from genotype in having smooth pseudostigmatic organs and longer notogastral bristles, the posterior ones being crispate. Differs from *E. gracilior* in length, shape and position of notogastral bristles. Total length of body 0.43 mm., total breadth 0.247 mm., length of notogaster 0.26 mm.

Cotypes: Sixty-two specimens from "white" oak litter, old-growth stand, compartment 5, Bent Creek Exp. Forest, Buncombe Co., N. Car.; taken June 11th, 1935, slide 35F3X–26.

Suctobelba grandis obtusa, subsp. nov.

Differs from species (12, p. 78, pl. 4, fig. 32) in that distal end of pseudostigmatic organs is blunt, obtuse, not pointed and not terminated by a curved bristle (flagelliferous).

Cotypes: Fifteen specimens from litter of thirty-year-old white pine plantation on Biltmore estate on Asheville-Brevard road about eight miles from Asheville, N. Car.; taken October 8th, 1934, slide 34F9.3–20.

Dameolus laciniatus americanus, subsp. nov.

Differs from the species (2, p. 236; 12, p. 82, pl. 5, figs. 35, 51) in that the pseudostigmatic organs are long, sinuous, head elongate fusiform, *compressed*, tapering to a point. Paoli figured the organ of the American form (4, p. 91, "Nota"). The interlamellar bristle ridge extends beyond the bristles to anterior edge of pseudostigmata, *usually* as a strongly developed ridge; rostrum broad; rostral and lamellar bristles longer, curved.

The notogaster and the arrangement of its twenty-two bristles is identical to that of specimens from Regensburg (Bavaria).

Cotypes: Thirty-seven specimens from dogwood (Cornus) litter of thirty year old-field woods, laboratory grounds, Bent Creek Exp. Forest, Buncombe Co., N. Car.; taken September 20th, 1934, slide 34F4.3–33.

By its mouth parts and the development of the rostral area, this genus is closely related to Suctobelba, perhaps more specialized.

Metrioppia serrata atlantica, subsp. nov.

Differs from the species (14, p. 185, figs. 4–6) in that bristles ad3 are on transverse plane of anterior edge of aperture; there are four to five minor camerostomal serrations in addition to the distal; abdomen relatively much shorter; notogastral bristles differently arranged.

Cotypes: Thirty-nine specimens from litter of thirty-year-old white pine plantation on Biltmore estate, Asheville-Brevard road about eight miles from Asheville, N. Car.; taken October 8th, 1934, slide 34F9.2–32.

Carabodes gibbiceps clavata, subsp. nov.

Differs from the species (5, p. 330) in that pseudostigmatic organs are clavate, copiously scabrate, the head slit so as to be cleft along one side.

Cotypes: Twenty-five specimens from short-leaf pine litter of isolated old-field stand on Asheville-Brevard road, two miles south of Bent Creek, Buncombe Co., N. Car.; taken October 15th, 1934, slide 34F10.3R4.

Cepheus mirabiloides, sp. nov.

Resembling *C. mirabilis* (1, p. 10) but notogastral bristles much shorter, those of posterior edge horizontal, more widely spaced; distal ends of lamellae not meeting, the bristles subapical; total length of body of males 0.53 mm., of females 0.6 mm.

Cotypes: Eight specimens from "white" oak litter, old growth stand, compartment 5, Bent Creek Exp. Forest, Buncombe Co., N. Car.; taken June 11th, 1935, slide 35F3X–14.

Rostrozetes foveolatus appalachicola, subsp. nov.

Differs from the species (13 p. 85, figs. 6, 7), in having twenty-two notogastral bristles and much coarser sculpturing on the genital and anal covers. The pseudostigmatic organ head is spiny, the spines being arranged in four longitudinal rows.

Cotypes: One hundred six specimens from dogwood (Cornus) litter of thirty year old-field woodland, laboratory grounds, Bent Creek Exp. Forest, N. Car.; taken September 20th, 1934, slides 34F4.3–51 and –52.

Anachipteria achipteroides australoides, subsp. nov.

Differs from the species in having pseudostigmatic organs of *A. australis* (7, p. 160, pl. 3, figs. 40, 41) which is regarded as a species. The lamellae are those of *A. achipteroides* (6, p. 119, pl. 8, fig. 16).

Cotypes: Eighteen specimens from Liriodendron-Fraxinus litter, south cove, Shut-in-Ridge, Bent Creek Exp. Forest, N. Car.; taken June 17th, 1935, slide 35F4X–31.

Achipteria armatum spinosum, subsp. nov.

Differs from the species (1, p. 9) in having no notogastral bristles; no anteroventral angle on pteromorphae; a spine on tectopedia II; and different parasternal bristles. The lamellae have a lateral cusp but it is invisible in true dorsal aspect.

Cotypes: Ten specimens from soil sample, Rocky Cove, Bent Creek Exp. Forest, Buncombe Co., N. Car.; taken April 25th, 1935, slide 34F33–29.

Microzetes auxiliaris appalachicola, subsp. nov.

Differs from the species (8) in having only two pairs of notogastral plicae, and the mesal edge of lamellae extending much further posteriad and laterad so that they join each other almost at anterior edge of notogaster. Arrangement of bristles of venter also differs.

Cotypes: Forty-nine specimens from mossy interspaces of Andropogon sod, old-field, Case Place, Bent Creek Exp. Forest, N. Car.; taken February 6th, 1935, slide 34F24–3.

In 1936 (May 30), p. 77 Grandjean showed that *Notaspis humeralis* is a Trichoribates, and renames the *Humerobates humeralis* of authors, entirely ignoring Banks' *Oribata arborea* and my paper on this species. Thus *Humerobates rostrolamellatus* Grandjean 1936 is a subspecies of *Oribata arborea* Banks 1895.

Sellnick made *Notaspis humeralis* Hermann the type of Humerobates. Since *N. humeralis* Herman is not *Oribata arborea* Banks, the latter species remains without generic designation. I propose the name

BANKSINUS, gen. nov.

Type: *Oribata arborea* Banks 1895, p. 7 (see Jacot, A Common Arboreal Moss Mite, Occ. Papers Bost. Soc. Nat. Hist., vol. 5, pp. 369–382, pl. 19).

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4. —— —— 1913, Acari nuovi, Manipoli VII and VIII.
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9. —— —— 1936 (May 30), Les Oribates de Jean Frédéric Hermann et de son Père, Ann. Soc. ent. France, vol. 105, pp. 27–110, 14 figs.

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11. Michael, A. D. 1885, New British Oribatidae.
11a. —— —— 1888, British Oribatidae, vol. 2.
12. Paoli, Guido. 1908, Monografia del Genere *Dameosoma* Berl. e Generi Affini.
13. Sellnick, Max. 1925a (May 30), Fauna Sumatrensis (Beitrag Nr. 6): *Oribatidae* (Acar.).
14. —— —— 1931b, Mexikanische Milben 1.

For further details see my Annotated Bibliography of the Moss Mites.

NESTS OF LEAF-CUTTING BEES IN DRIED FIGS.

By Heber C. Donohoe,

Division of Fruit Insects, Bureau of Entomology and Plant Quarantine, United States Department of Agriculture.

During the fall of 1935 several inquiries about leaf-cutting bees in Calimyrna figs were received at the Dried Fruit Insect Laboratory, Bureau of Entomology and Plant Quarantine, at Fresno, Calif.

The bees construct cylindrical cases within the cavity of a fig by means of leaf segments carried in through the eye, provision these cases with pollen, and seal each tube with a circular cap of leaf segments. As this foreign material partially or entirely fills the fig cavities, the figs so provisioned are of cull grade.

A grower in the Figarden district, near Fresno, directed the writer to the portion of his fig acreage from which several figs showing this injury had come. This part of the orchard lies on both the east and west sides of an irrigation canal. A search of the area October 1 and 3, revealed that the leaves used in nest construction were predominantly or entirely those of a species of *Polygonum* (knotweed) growing as scattered plants on the ditch banks close by the water's edge. The edges of many leaves of these plants were riddled with smooth, cut-out areas typical of the work of leaf-cutting bees, while none of the other wide variety of wild vegetation along the ditch had been so injured. A single willow tree growing in a nearby field showed slight, but mainly irregular, cut-out sections, some of which may have been caused by bees. Since the leaves were being attacked by sphinx caterpillars it is more probable that they, or grasshoppers, were responsible.

The leaves of *Polygonum* and the segments from several nests were compared microscopically by C. H. Quibell, systematic botanist at Fresno State College, and the writer, and found to be identical.

On October 1 and 3 no bees were found in the act of cutting segments or entering figs, but on the latter date two species of Megachilidae were present along the ditch banks in some

numbers. These bees were mainly frequenting the flowers of a hedge nettle, *Stachys albens* Gray, a species of wild Labiatae (mint family), which were producing an abundance of yellow pollen. One species proved too elusive to capture; specimens of the other were identified by Miss Grace Sandhouse of the Bureau of Entomology and Plant Quarantine and by Dr. T. B. Mitchell of the University of North Carolina as *Anthidium maculosum* Cresson, a species which constructs its nests of plant fibers. On microscopic examination of the pollen in one of the nests, it appeared to consist of many types of pollen grains, differing from one another in size, shape, and reticulation, suggesting that several species of plants are visited in provisioning nests. Pollen from the pollen basket of one of the bees appeared identical microscopically with one of the types from the nest. Attempts to rear adults from the nests in the laboratory were unsuccessful.

While time did not permit verification, these observations suggest that in this curious association of organisms the bees construct nests in fruits of *Ficus* (Moraceae) from leaf-segments of *Polygonum* sp. (Polygonaceae) and provision these nests with pollen from several other species of plants, including *Stachys albens*, of the family Labiatae.

Since no bee activity was discovered in the orchard it is not known whether the nests are constructed in figs on the trees or on the ground, though the ground is the more probable location. Figs for drying ripen and fall and are harvested from the ground at intervals throughout the season. Several figs containing nests had such small eyes that it seems quite impossible for the bees to have entered during nest construction. As many as three cases were found within a single fig.

Mr. G. H. Kaloostian, while a member of the fig testing staff of the Dried Fruit Association of California, during the examination of many thousands of Calimyrna figs discovered two figs which contained another peculiar type of nest. In these the interior of the fruit was filled with a mass of plant fibers surrounding a tubular chamber which opened through the eye of the fig. It was not possible to trace the origin of the figs containing these nests back to the orchard. According to Dr. Mitchell they are evidently the work of *Anthidium maculosum*.

Mr. Elroy Robinson, student curator in botany at Fresno State College, and the writer, attempted to determine the species of plant from which the fibers for these nests were obtained. Microscopic comparisons of the nest fibers with fibers from leaves and stems of a variety of plants indicated, with little doubt, that the nests were constructed of fibers from the hairy covering which envelops leaves, stems, and flowers of *Stachys albens*.

THE NEARCTIC SPECIES OF PIKONEMA, A GENUS OF SPRUCE SAWFLIES (HYMENOPTERA, TENTHREDINIDAE).

By Herbert H. Ross,
Illinois State Natural History Survey, Urbana, Illinois.

During the last few years Mr. R. E. Balch and his co-workers, of the Dominion Entomological Branch of Canada, have reared from spruce many lots of sawfly larvae belonging to the *Pachynematus ocreatus* group, or "group I" of Marlatt. These reared series have established for the first time the correct association of the two sexes of the species and show that color is of little value in segregating the species. Since the names hitherto used are considerably jumbled, this effort is made to organize them with the recent advances in our knowledge of their larvae.

PIKONEMA Ross.

Pikonema Ross, Illinois Biological Monographs, 15 (2) : 86. 1937.

This genus was erected for the "ocreatus" group hitherto placed in *Pachynematus* on the basis of the incised clypeus and small inner tooth of the tarsal claws. It differs from this genus, however, in the long, shining sheath of the female and the narrow, elevated procidentia of the male. The larvae and male genitalia resemble most closely some species of *Amauronematus*. The adults differ from those of *Amauronematus* in the non-flattened head and the small inner tooth of the tarsal claws.

A study of some European species shows that there exist some, such as *Pachynematus scutellatus*, which resemble *Pikonema* closely in external characters but on the basis of male genitalia are undoubtedly true *Pachynematus*.

Characteristics.—Venation typical of the higher Nematinae. Clypeus emarginate. Antennae long and setaceous. Ocellar basin bounded by distinct walls, which are somewhat rounded. Fovea between antennal sockets variable in shape. Head and body surface shining, with only inconspicuous punctation. Tarsal claws with a small inner tooth some distance below apex of outer one. Female sheath long, projecting considerably beyond cerci, figs. 9–11, more or less round at the end, with the lateral surface highly polished, and the apex with a fringe of fine setae. Male with apical sternite long, tapering to a narrow, semi-truncate tip; procidentia of eighth tergite narrowed towards base, its apex projecting beyond apex of segment.

Larvae distinguished from allied forms by the following combination of characters: Body cylindrical, not markedly tapering at apex, fig. 17. Apical tergite round, without sharp lateral processes. Head variable in color but body always with longitudinal banding as in fig. 17, sometimes paler. The only differences I have found between the species are given in the key.

Genotype.—*Nematus dimmockii* Cresson (original designation).

Key to Adults.

1. Apical sternite undivided (males) 4
   Apical sternites divided by a sheath (females) 2
2. Apex of saw round, fig. 8 ..... *dimmockii*
   Apex of saw pointed, figs. 6, 7 3
3. Dorsal margin of sheath evenly convex, not notched at apex, fig. 11 *ruralis*
   Dorsal margin of sheath notched at apex, fig. 10 ..... *alaskensis*
4. Apex of sagittae and volsellae of same height and fused, fig. 5 ..... *dimmockii*
   Apex of sagittae higher than volsellae, not fused, fig. 4 ..... *alaskensis*

Key to Larvae

1. Head green ..... *dimmockii*
   Head chestnut brown, sometimes with a mottling of dark brown over the chestnut, and sometimes almost black ..... *alaskensis*

Pikonema dimmockii (Cresson).

Nematus dimmockii Cresson, Trans. Amer. Ent. Soc., vol. 8, 1880, p. 6, ♀. Type* at the Academy of Natural Sciences, Philadelphia, Pa.

Nematus ocreatus Harrington, Can. Ent., vol. 21, no. 5, May, 1889, p. 95, ♀. *New synonymy*. Type in the Canadian National Museum, Ottawa, Can.

The female is readily distinguished by the long sheath and rounded saw, figs. 8, 9, 12. The abdomen varies in color from completely chestnut to almost entirely black, with all intergradations.

Male.—Similar in general structure to the female. Length 8.0 mm. Color: head a mottling of cream color, chestnut and black; thorax mostly black with scattered marking of cream and chestnut; abdomen black.

Genitalia distinctive. Sagittae and volsellae slender, rounded and fused together at apex, fig. 5. Penis valves with lateral flap studded at bulge with short spines, bearing at apex two teeth, a long, sharp, dorsal one and a short, blunter, ventral one, fig. 1.

Allotype, male; Cascapedia River, Quebec, reared June 28, 1934, from *Picea canadensis*, M. L. Prebble. Deposited in the Canadian National Museum.

Distribution.—Idaho—Moscow Mt.: July 11, 1 ♀; June 8, 1921, 1 ♀. Manitoba—Aweme: June 2, 1922, 1 ♀. New Brunswick—St. Johns: June 9, 1901, 1 ♀. New Hampshire—Mount Washington: 1 ♀. Quebec—Grand Cascapedia: reared ♂, ♀ from *Picea canadensis* and *P. mariana*.

Mr. G. S. Walley of the Canadian National Museum has kindly compared the type of *ocreatus* with specimens and drawings. He reports that the characters of sheath and saw can be seen on the type and are as herein represented.

Pikonema alaskensis (Rohwer), new combination.

Pachynematus ocreatus auct., nec Harrington.

Pachynematus alaskensis Rohwer, Proc. U. S. Nat. Mus., vol. 41, no. 1866, Oct. 14, 1911, p. 387, ♂, ♀. Types* in the U. S. National Museum, Washington, D. C.

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* Types which have been studied by the author are marked with an asterisk.

Pachynematus piceae Rohwer, ibid., ♂, ♀. *New synonymy.* Types* in the U. S. National Museum, Washington, D. C.

A series of 40 females indicates that the color of the abdomen is usually chestnut with occasional dark suffusions at the base, but varies to entirely black. The male seems to have the abdomen always banded with rufous. The narrowness of this band in some specimens may indicate that sometimes the abdomen is entirely black in this sex also.

The male genitalia differ from those of *dimmockii* as follows: sagittae with apex tapering to a point, and projecting beyond apex of volsellae, fig. 4; penis valve with only a long, dorsal tooth at apex of lateral flap, figs. 2 and 3. The female sheath always has an incision on the dorsal corner of the apex, fig. 10. The saw resembles that of *ruralis*, terminating in a point, figs. 7, 16.

Distribution.—Alaska—Sitka: April 19, 1899, T. Kincaid, 3 ♀. Alberta—Edmonton: June 9, 1932, E. H. S., 1 ♀; Gull L: June 20, 1929, E. H. S. 1 ♀. British Columbia—Vernon: May 10, 1934, reared from *Picea engelmanni*, 1 ♂, 3 ♀; Needles: May 29, 1934, 1 ♀. Idaho—Moscow: July 14, 1898, 1 ♀; Mt. Moscow: July 11, 1 ♂. Manitoba—Winnipeg: 7 ♀; Aweme: June 8–15, 1917, from spruce, N. Griddle; Transconia: May 28, 1926, 1 ♂; Clear Lake, Riding Mt. Park: June 4, 1936, H. E. M., 1 ♀. Michigan—Grand Island: July 27, 1907, A. D. H., ♂, ♀. New Brunswick—Frederickton: June 4, 1933, R. E. Balch, 1 ♂, 2 ♀, reared from *Picea canadensis*. Quebec—Cascapedia: many reared series from spruce, *Picea;* Lake St. Anne: reared ♂ and ♀ from *Picea mariana;* Berthierville: May 21, 1934, reared from Colorado Blue Spruce, 2 ♂. Saskatchewan—Sutherland: June 6, 1928, reared from spruce, 1 ♀. Wyoming—Yellowstone N. P.: June 19, 1930, at the Thumb, 1 ♀.

Pikonema ruralis (Cresson), new combination.

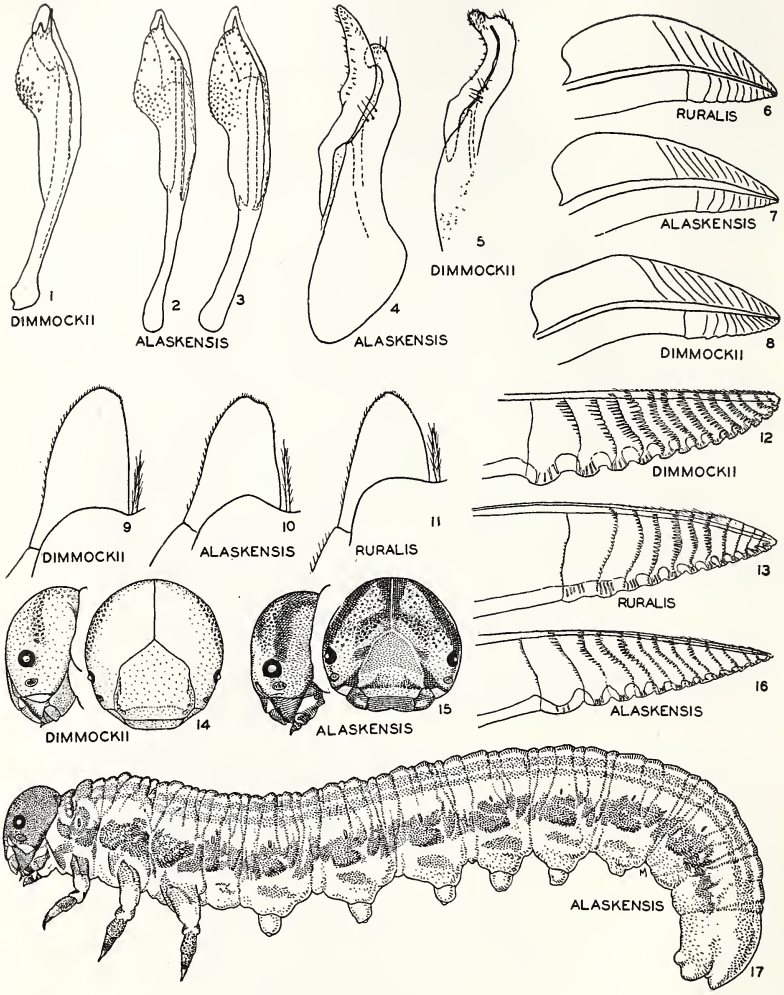
Nematus ruralis Cresson, Trans. Amer. Ent. Soc., vol. 8, 1880, p. 5. ♀. Type* at the Academy of Natural Sciences, Philadelphia, Pa.

The male and larva are unknown. The female sheath and saw are shown in figs. 6, 11, 13. I have seen only five females of this species and in these the abdomen has the dorsum dark brown except for the extreme apex, this and the sides straw color and the sternites varying from straw color to brown.

Distribution.—Oregon—Crater Lake: July 19, 1922, 3 ♀; Mt. Hood: June 24, 1925, 1 ♀.

Plate 1— Parts of *Pikonema* Species.

1 — 3	Penis valves
4 — 5	Sagittae and volsellae
6 — 8	Saws
9 —11	Sheaths
12, 13, 16	Apical portion of lancets
14—15	Lateral and frontal views of larval heads
17	Lateral view of entire larva


1
DIMMOCKII
2
3
ALASKENSIS
4
ALASKENSIS
5
DIMMOCKII
RURALIS 6
ALASKENSIS 7
DIMMOCKII 8
9
DIMMOCKII
10
ALASKENSIS
11
RURALIS
12
DIMMOCKII
13
RURALIS
16
ALASKENSIS
14
DIMMOCKII
15
ALASKENSIS
ALASKENSIS 17

REPORT OF THE TREASURER FOR THE YEAR 1937

The year 1937 has been a very unusual one in regard to increase in expenditures but even more unusual because of the increase in receipts, particularly in funds derived from the sale of back numbers and sets of our Proceedings. Receipts obtained from the collection of old debts amounted to $245.54, which is $26.96 less than collected from this source last year. Late in the year the closed District National Bank declared a third dividend which gave to our Society $45.82. Only fifteen percent of the obligation of this bank to the Society now remains unpaid. This obligation is not listed in this report as an asset. A tabular summary of receipts and expenditures for the calendar year 1937 is here given:

Receipts

Cash on hand (Jan. 1, 1937)	$532.05
From members, dues for 1937	416.00
dues paid in advance	9.00
back dues	166.95
initiation fees	6.00
From subscribers, for subscriptions to Proceedings	530.52
for entire cost of articles	44.51
From authors, for separates and author's copies	120.23
for entire cost of articles	66.39
for illustrations	12.51
From sale of back numbers of Proceedings	647.38
exchange and donated literature	33.83
From dividend paid by District National Bank	45.82
Net receipts	$2,631.19

Expenditures.

To H. L. & J. B. McQueen, Inc., for printing Proceedings (No. 9 of Vol. 38 and Nos. 1–9 of Vol. 39) and separates	$1,531.79
To H. L. & J. B. McQueen, Inc., for printing programs of meetings	25.50
To Southern Engraving Co. for engravings	186.17
To Kirby Lithographic Co. for facsimile reprinting of 100 copies each of Vol. 31, No. 4 and Vol. 32, No. 8 of Proceedings	50.60
For stationery	33.66
For stamps	33.35
For express and shipping charges, including packing expenses and second-class postage	22.15
For clerical help, Office of Corresponding Secretary	60.00
For rent, 1937, of safe deposit box at The City Bank	3.85
For refreshments, June meeting	5.00
For miscellaneous expenses	8.80
Total expenditures for 1937	$1,960.87

Receipts from sale of three complete sets of Proceedings transferred to publication fund	289.35
Cash on hand (Jan. 1, 1938)	380.97
Outstanding obligations	none
	$2,631.19

PUBLICATION FUND

Schwarz donation, principal	$1,000.00
accumulated dividends 1927–1936	553.32
Knab bequest (in savings account)	150.00
covered by a five year personal, non-interest bearing note	1,250.00
General unrestricted fund, principal	289.35
interest for 1937	4.00
Total in publication fund	$3,246.67

Respectfully submitted,

H. E. EWING,
Treasurer.

Audited and found correct.

B. A. PORTER,
E. C. CUSHING,
Committee on Audit, January 5, 1938.

MINUTES OF THE 487TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 487th meeting of the Society was held at 8 P. M., Thursday, December 2, 1937, in Room 43 of the National Museum, with forty-three members and twenty-eight visitors present, and the President in the chair. The minutes of the previous meeting were read and approved.

The Chairman of the Membership Committee presented the name of E. R. McGovran, of the Beltsville Entomological Laboratory, who, upon recommendation of the Executive Committee, was unanimously elected to membership.

The chair summarized, in brief fashion, the work of the Society for the year and thanked the officers for their cooperation.

The Treasurer presented a partial report, covering the first ten months of 1937. (See full report following minutes in this issue.)

The Corresponding Secretary then gave his report for the year 1937, through November 30, which is summarized as follows:

Copies of Proceedings on hand	31,461
Copies reprints on hand during 1937	13,987
Total net value of sales	$639.95
Number of members in 1937	210
Number of subscribers in 1937	120

Mr. Snodgrass made a motion that these reports be accepted by the Society, and the motion was passed.

Austin H. Clark, Chairman of the Nominating Committee, on behalf of his committee, consisting of C. E. Burnside, Alan Stone, J. S. Wade and W. B. Wood, submitted the following list of nominations for the offices of the Society for 1938:

President	E. A. Back
First Vice-President	R. E. Snodgrass
Second Vice-President	Lee A. Strong
Recording Secretary	Ashley B. Gurney
Corresponding Secretary	D. J. Caffrey
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Vice President, Washington Academy of Sciences	C. F. W. Muesebeck

F. M. Wadley moved that the Secretary be instructed to cast a unanimous ballot for the election of these officers. The motion was carried.

The first paper on the regular program, entitled "Evolution of the Prosoma of Arachnida," was given by R. E. Snodgrass.

This paper was discussed by Cushman and Ewing.

Mr. R. E. Snodgrass gave a brief discussion, illustrated with lantern slides, of the comparative structure of the trilobite head and the prosoma of Xiphosurida and Arachnida, showing that there can be little doubt of a direct relationship of the Chelicerata with the Trilobita. (Author's abstract.)

Miss Mabel Colcord presented the second paper, entitled "New Books of Interest," in which she made interesting comments on current literature.

The third paper was given by H. S. McConnell, and entitled "Additional Notes on *Oocenteter tomostethae*."

[*Oocenteter tomostethae* Cushman was recently described as a new genus and new species. It apparently belongs to the tribe Tryponini of the family Ichneumonidae. The species is of interest because of its biology and some anatomical features of the first stage larva. *Oocenteter tomostethae* is one of the small number of Ichneumonidae that oviposits in the egg of the host, but does not destroy the host until the host larva is fully grown.

[The parasite and host, *Tomostethus multicinctus* (Rohw.), appears as adults during the last few days of April in the vicinity of the University of Maryland. As soon as the leaf buds of white ash (Fraxinus americana) begin to unfold, *Tomostethus* starts to oviposit in the margins of the unfolding leaflets, and by the end of the first week of May practically all its eggs have been laid and a majority have hatched. *Oocenteter* begins to oviposit in the eggs of *Tomostethus* as soon as they are available. The incubation period of the host is from 6 to 8 days, and that of the parasite about 5 days. The parasite eggs are placed in the yolk cells of the host egg, and thus the parasite egg or young larva becomes enveloped in the mesenteron of the host. About the time the host eggs hatch, the parasite larva migrates from the mesenteron and takes up a position in the thoracic segments ventral to the digestive tract, but above the fat body. The head of the parasite larva is almost invariably toward the head of the host larva. The parasite larva maintains this position during the entire feeding period of the host, which is approximately two weeks.

[The *Tomostethus* larvae become full grown between the 14th and 18th of

May; while the parasite larvae do not molt during the feeding period of the host, they increase greatly in size. A rather unusual feature of the first stage larva is the anal vesicle. After the first molt, the vesicle invaginates to its normal position. When the host larvae finish feeding they enter the soil beneath the tree, form earthen cells, and change to prepupae; in this condition they pass the winter and pupate about the middle of April.

[The length of the first instar of the parasite is about the same as that of the other four instars combined. The first molt occurs when the host has finished feeding and is ready to enter the ground. After the host has entered the ground, the parasite larva develops rapidly, and becomes full grown about June 1. It spins its cocoon in the earthen cell of the host. The larva spends a quiescent period of about three and a half months, and begins pupating September 15. Pupation is completed by October 15, and a few have emerged within the cocoons. By November 15 all have emerged within the cocoons. The adults spend the entire winter in their cocoons with the tip of their abdomens imbedded in the liquid meconial mass.] (Author's abstract.)

E. C. Cushing stated that special rates for transportation to the December meetings of the American Association for the Advancement of Science were available and that information concerning them might be secured from Mr. Hyslop.

Upon invitation from the chair, the following visitors introduced themselves: Dr. Grace H. Griswold, Ithaca, N. Y., and L. G. Baumhofer and Randall Latta, both recently transferred to Washington.

A sound movie of the Periodical Cicada, which could not be shown at the June meeting because of inclement weather, was presented by J. A. Hyslop. Following this, one of the operators gave a brief explanation of the method of recording and reproducing the sound.

Mr. Hyslop announced the election of R. E. Snodgrass as an Honorary Fellow of the Royal Entomological Society of London, and in response to the applause greeting this announcement, Mr. Snodgrass made a few remarks.

Adjournment followed at 10:15 P. M.

CATHERINE FORD,
Recording Secretary.

Actual date of publication, January 31, 1938.

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PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

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THE SENSES OF INSECTS COMPARED TO THOSE OF HIGHER ANIMALS.[1]

By N. E. McIndoo,

Senior Entomologist Bureau of Entomology and Plant Quarantine, United States Department of Agriculture.

For decades there has been a controversy as to whether insects have senses similar to those of the higher animals. If they do, then should the sense organs of insects and vertebrates be similar in structure? A few writers say that we should not try to compare the senses of insects with those of the higher animals, because the anatomical organization of the former is quite different from that of the latter. Regardless of whether we are justified in making this comparison, it is commonly done, and, even if there is a controversy about the fundamentals of the subject, much nevertheless has been accomplished economically during the past decade by using attractants, baits, repellents, and various kinds of light traps.

In this brief paper the economic aspects of the subject will be only mentioned here and there. The literature on the senses of insects and the higher animals is very extensive, but, since most of it does not treat the subject in a comparative way, very little of it can be used in this connection, and only a few of the references can be cited here.

THE SENSE OF SIGHT.

In regard to sight, the highest attainments pertain to the perception of form and color. Man and some of the higher animals perceive the shape and color of objects and so do insects, but the latter not exactly as we do.

Perception of form.—According to a reviewer (*6*)[2] Von Frisch (*12*) demonstrated that honeybees can be trained to distinguish forms of objects. Food was given to them in a closed box, into which they were obliged to crawl through a hole. Around this hole was glued the picture of a flower, while around a hole in another box, which was empty and which was put beside the

[1] Address delivered by the retiring President of the Society at the January, 1938, meeting.

[2] Italic numbers in parentheses refer to Literature Cited, p. 34.

first, was glued the picture of another flower. After food had been given thus for several days, the boxes, which could be distinguished only by the difference in the pictures of the flowers, were put before the bees empty. A much greater number of visits were paid to the box which had previously contained food. Bees, therefore, are able to distinguish between two flowers according to their shape. Similar tests were also made by use of simple geometrical figures.

Perception of color.—During the time of Darwin the lower animals were supposed to have a color sense. Hess said that all invertebrates and fishes were totally color blind and that only the highest forms—mammals, birds, reptiles, and amphibians—were able to see colors. Later researches have shown that cuttlefishes, insects, and the higher Crustacea do possess a sense of color (*6*).

All animals that possess a certain amount of intelligence can be trained to distinguish colors. Von Frisch was the first to attempt this, with bees. He used the "chess-board" method. On a square board were fixed a large number of pieces of cardboard of all shades of gray, from the lightest white-gray to the darkest black-gray. Among these was placed a piece of cardboard of the color on which the bees had been trained (blue). The results showed that the bees had a color sense. The trained bees, having been accustomed to find their food on a blue background, flew to the blue pieces of cardboard only and paid no attention to any of the others (*6*).

The color sense of bees has been further studied by Kühn. Bees perceive all wave lengths between 650 and 313 millimicrons ($m\mu$). Within this range they distinguish four different colors. The first comprises wave lengths from 650 to about 500 $m\mu$ and includes our red of shorter wave length, and also yellow and green. All these appear to them as one color. The red of longer wave length, which we use in our photographic dark rooms, is not distinguished by bees at all; they confuse it with black. The second comprises wave lengths from 500 to 480 $m\mu$ and corresponds to our blue-green, and the third lies between 480 and 400 $m\mu$ (our blue and violet). Lastly, bees perceive a fourth visual region in the ultra-violet which is beyond our perception. It lies between 400 and 310 $m\mu$. Bees may, therefore, be trained to distinguish ultra-violet just as well as blue or yellow (*6*).

It can be proved that animals, including man, respond differently to light and its color, according to conditions under which they find themselves. If they are tested with Schlieper's optomotor they sometimes act as if they were color blind, even those definitely known to have a color sense. Butterflies and moths when tested in this apparatus reacted sometimes as if perceiving colors, at other times as if color blind (*6*).

In tests in which Hering's colored papers were used, the relative brightness values of green, yellow, blue, and red were slightly higher for bees than for man (dark adapted) but were considerably lower than those for man (light adapted) (*6*).

Lutz (*17*) used colored filters as windows in a box and determined that insects (particularly Lepidoptera) can readily distinguish ultra-violet waves. In every case in which an insect reacted to any illumination, either clear or colored, it definitely reacted to ultra-violet. Flower-visiting insects did not see red to green as well as they did blue to ultra-violet. They appeared to see ultra-violet better than they did colors that seem bright to us. Some flowers reflected ultra-violet waves, others did not, while still others had an ultra-violet pattern. He concluded that ultra-violet flowers are no more popular with insects than are flowers reflecting only the colors that are visible to man.

Bertholf (*3*) states that Von Frisch and Kühn concluded that bees distinguish only enormous differences in brightness while Hess believed that bees are practically as acute as man in this ability. Bertholf concludes that neither statement is correct, for bees begin to distinguish between two illuminated areas when the intensity of one is reduced to at least 70 percent of the intensity of the other, whereas human beings distinguish between them equally well when the intensity of the one is reduced to only 90 percent of that of the other. The upper limit of the spectrum for the honeybee extends to at least wave length 677 $m\mu$ in the red, and not only to 650 $m\mu$ found by Kühn. The point of maximum stimulative efficiency for the bee is in the yellow-green at about 553 $m\mu$, which corresponds closely with that of man. From this point the efficiency decreases more rapidly for bees than for man toward the longer wave lengths, but more slowly than for man toward the shorter wave lengths, being at 431 $m\mu$ still fully 10 percent of the maximum. Man is considerably more acute than bees in ability to distinguish differences in brightness.

Bertholf (*4*) continued his work on the honeybee and says that the efficiency is highest at wave length 365 $m\mu$ and that the spectrum extends at least down to wave length 297 $m\mu$ but not to 280 $m\mu$. When the curve representing the distribution of efficiency in the ultra-violet spectrum is joined to that for the so-called visible spectrum, there are shown to be two maxima, one in the yellow-green at wave length 553 $m\mu$, and the other in the ultra-violet at 365 $m\mu$, the latter being about 4½ times as great as the former. Bertholf (*5*) continued his work by using *Drosophila* (Diptera). The curve starts to rise at 575 $m\mu$ and reaches a maximum in the visible spectrum at 487 $m\mu$, then descends to 425 $m\mu$, again rises quickly and attains a maximum at 365 $m\mu$, then descends to 250 $m\mu$.

Light traps.—Artificial light as a control measure was probably first used in 1787 for attracting vine moths in Europe. Since that date light traps have been gradually developed and improved until to-day there are many types and varieties of gasoline, kerosene, acetyline, and electric lamps used for this purpose. Most of these have been devised primarily for catching Lepidoptera, Coleoptera, and Diptera. It seems that none, however, has given complete satisfaction as a control measure (*19*, *20*). The light traps devised for mosquitoes are not used as a means of control, but merely to catch as many species as possible in order to study the distribution of species in a given place.

THE SENSE OF SMELL.

The olfactory organ.—This organ in the higher animals consists chiefly of supporting cells and olfactory cells. The distal ends of the latter project slightly beyond the level of the mucous membrane, where they and their cilia are usually protected by a copious supply of mucus secreted by the supporting cells (*31*). The cilia, which are the true receptors of smell, vary in number, there being from one to twelve or more per cell. In man, according to Parker, each cell has six to eight cilia; in the pig, five to eight; in the frog, five or six very long cilia; and in a fish each cell has only one, but it is still longer, being twice the length of the cell, and consequently extends through and beyond the slime covering the ends of these cells. Hopkins (*15*) says that the cilia of amphibians and turtles pass through the mucus and come in contact with air in the olfactory chambers. In bony fishes the cilia pass through the mucus and are supported by water. Thus in the water-inhabiting forms the cilia pass through the mucus and are supported by water. In the semi-aquatic forms the cilia pass through the mucus and may or may not be supported by water, but in the totally land-inhabiting forms the cilia seem not to pass through the mucus which supports them. Hopkins states that the histological reagents used have a destructive effect on the delicate cilia, reducing them to only a fraction of their normal lengths. In view of this statement the olfactory cilia of man and other higher animals may really pass through the mucus into the air.

Nearly all who have studied the so-called olfactory organs of insects claim that certain innervated hairs and pore plates on the antennae are the olfactory receptors. Since these structures are covered with chitin, the writer has argued that odorous air can not reach their nerves. He claims that only the "olfactory pores" receive odorous stimuli. These structures were called Hicks' vesicles in his first manuscript on the subject, but the reviewer changed the name to "olfactory pores." Other

students have failed to see the sense fiber pass through the thin membrane covering the porelike organ. The writer has repeatedly said that it can be seen only in the thinnest sections of the very largest organs. If the sense fiber really passes through this membrane and comes in contact with the air, then this organ somewhat resembles that in fishes. If it does not pass through this membrane, it is yet more suitable as an olfactory organ than most of the innervated hairs described as olfactory receptors.

Acuteness of smell.—As examples of higher animals under this heading, blind people, dogs, and aborigines may be cited. A boy, James Mitchell, was born blind, deaf, and dumb, and depended chiefly on smell for keeping himself in touch with the outside world. He readily observed the presence of a stranger in the room and formed his opinions of persons apparently from their characteristic smells (*23*).

It is well known that dogs can trail men and animals merely by smell. To prove this scientifically Buytendijk (*7*) had a boy to walk on a level sandy place. After the boy had finished his trip, a police dog was led to where the boy had started and was allowed to smell the boy's cap. The dog then followed the trail almost perfectly. Darwin (*9*) cites the observations of Humboldt, who reported that certain Peruvian Indians could follow a trail by scent as reliably as a dog.

To match the preceding with what insects can do by the use of smell, we know that ants and termites can follow their tracks and that they and honeybees communicate largely by smell, and this is done supposedly by means of the individual, family, and hive or nest odors. Von Frisch (*13*) has gone so far as to call smell the "language" of honeybees, and states that it is used for communication in food getting. Bees returning to the hive with nectar announce the fact by the round dance, while those returning with pollen do likewise by the tail-wagging dance. The dance in each instance excites the attendant bees to leave the hive, but now they must find the nectar or pollen and this is accomplished by two means. Von Frisch believes that the bees remember the odor of the food wanted and when they are near the source of this food they smell the body odor left by other bees collecting it.

Of all the aromatics tested by various investigators, artificial musk has been found the most stimulating and it thus stands at the head of all olfactory stimuli perceived by man. The most active mercaptan tested by Allison and Katz (*2*) was perceived by them at a concentration of 0.006 milligram per liter of air, which is equal to 6/1,000,000 of a milligram per cubic centimeter. In regard to insects we have no figures to compare with these.

In a study of light reactions we have apparatus to measure

accurately the intensity and wave length of light, but in regard to the chemical senses we must depend on the olfactory and gustatory organs, which vary widely in function in individual animals. We need a mechanical nose so that odors could be classified and standardized on the basis of their intensity and quality. The proper procedure on classification was started by Crocker and Henderson (*8*), who divided the elementary odor sensations into four components, called fragrant, acid, burnt, and caprylic. They assigned four-digit numbers to the odors characterized. The individual figures indicate intensity on a scale of 8. For example, the number 6523 represents the smell of geraniol; the 6 indicates a strong fragrant or sweet sensation; the 5, a strong acid or fruity sensation; the 2, a very weak burnt sensation; and the 3, a weak caprylic or goaty sensation. With a fairly good nose it might be possible to characterize 6,561 different odors. With the aid of a set of standards, consisting of 32 pure chemicals and essential oils, it is possible to classify most of the odors being investigated.

Olfactometers.—To overcome our handicap as much as possible we have developed olfactometers. The olfactometer used by physiologists was perfected by Zwaademaker in 1895. Barrows in 1907 devised an apparatus with which he determined that *Drosophila* reacts to the odors from fruit juices. The writer in 1926 made an apparatus, called an insect olfactometer, and determined for the first time that insects actually respond to odors from their host plants (*18*). Ripley and Hepburn (*28*) devised a very complicated olfactometer in which they successfully tested the responses of the Natal fruit fly to odors from various sources. Folsom (*11*) made a chemotropometer in which he tested the responses of the cotton boll weevil. Eyer (*10*) used an olfactometer in tests with codling moths. The writer (*21*) devised a simple olfactometer in which he easily obtained the responses of blowflies to the odors from various kinds of foods and related substances. Hoskins and Craig (*16*) constructed a complicated olfactometer to test the responses of blowflies, and Marshall (*24*) tested honeybees in an olfactometer.

Other writers have recently made and used various kinds of insect olfactometers, but they have published little or nothing about them. Savory (*29*) has even made an olfactometer with which he determined that spiders smelled one another, and that the scent from a female caused the male being tested to perform the courtship actions. It is thus evident that different types of olfactometers must be used for different species of insects and spiders. With the aid of them we can carefully study for the first time the responses, and this greatly helps us when we are searching for attractants and repellents to be used in control measures.

Attractants and repellents.—The literature under this heading

was partly reviewed under the subjects of chemotaxis, baits, and repellents (*19*, *20*).

THE SENSE OF TASTE.

The gustatory organ.—In man this organ is a group of sense cells whose free ends project into a pore which opens on the surface of the tongue. Materials to be tasted are mixed with or dissolved by saliva in the mouth, and this liquid comes in direct contact with the free ends of the gustatory cells. In insects there is no such arrangement. Their so-called taste organs are various kinds of innervated hairs whose nerves are covered with chitin. The writer has therefore argued that insects do not have a true gustatory sense, because (1) they do not have suitable taste organs, and (2) no one has ever eliminated smell or satisfactorily controlled it while obtaining the supposed gustatory reactions of insects.

If it were not for this criticism, many investigators have given sufficient proof that insects can really taste. Snodgrass (*30*, *p. 63*) says "that the experimenter who claims a sense of taste for insects must demonstrate it with tests that will clearly avoid a confusion between taste and smell." Von Frisch and Minnich are perhaps the strongest advocates of a gustatory sense in insects, yet they have not complied with Snodgrass' criticism.

Gustatory experiments.—Minnich (*26*), in a review of this subject, says that Von Frisch (*14*) trained bees to feed on sugar solutions without and with the addition of other substances. For saccharose solution alone the threshold was about eight times more concentrated than the human threshhold. Fructose tastes twice as sweet as glucose to us, but less sweet to bees. Lactose appeared to be completely tasteless to bees. Certain other substances which are sweet to us appeared to be almost or totally tasteless to bees. In regard to sour and salty tastes, the gustatory perception in man and bees was about the same, but in regard to bitter tastes this sense was much higher in bees than in man.

Minnich first observed that when the tarsi of certain insects were touched with water or sugar water the proboscides were immediately extended. He and his students have written several papers on the contact chemoreceptors of butterflies, blowflies, and honeybees. They have concluded, merely from experimental results, that the tarsi bear taste organs. The present writer has objected to this conclusion for two reasons: (1) The sense of smell was neither eliminated nor satisfactorily controlled while the supposed gustatory sense was being tested; and (2) the supposed taste organs on the tarsi have never been found and described. Minnich (*25*) states that the tarsal

sensitivity of a butterfly (*Pyrameis atlanta* L.) to saccharose solution may be as much as 256 times that of the human tongue. In a more comprehensive paper (*27*) he determined that the tarsal chemoreceptors of blowflies were able to distinguish various sugar solutions from distilled water. They were from 100 to 200 times more sensitive to saccharose than the human tongue.

The present writer (*22*) used Minnich's technic and showed that it is not necessary to assume that the tarsi bear taste organs, for three reasons: (1) A tarsus bears no sense organs except nine olfactory pores; (2) it is almost impossible to wet the tarsi with water or sugar water; and (3) when the blowflies were in the proper nutritive condition and the liquids were about 3 mm. from the tarsi, the insects were induced by a special method to exhibit the proboscis response. It was further clearly demonstrated that the tarsi can easily distinguish between chemically pure saccharose water and distilled water when these liquids are about 3 mm. from the tarsi. The responses obtained are caused by two stimuli, one mechanical and the other olfactory. The act of touching the feet produces the initial stimulus and brings the liquids almost in contact with the olfactory pores on the tarsi.

Abbott (*1*), in a brief review of the gustatory sense of insects, discusses Minnich's conclusions and then remarks that "A more interesting conclusion is that of McIndoo, who claims that the tarsal organs are olfactory. He points out that, because of the presence of hairs, it is very difficult to wet the feet of flies, and that experiment demonstrates that they react to sugar solutions when these are yet some distance (2 or 3 mm.) from the tarsi."

The human nose ordinarily can not distinguish sugar water from distilled water, nevertheless Buytendijk (*7*) makes the remarkable statement that more than one person has been known to be able to smell sugar in tea and salt in soup, and that a police dog smelled common table salt and quinine in solutions at a concentration of 1 to 10,000.

THE SENSES OF TOUCH AND HEARING.

These two physical senses are more or less related, but perhaps much more so in insects than in the higher animals. In insects the only known tactile organs are innervated hairs, but in mammals there are tactile corpuscles and tactile hairs, the latter being well represented by the so-called whiskers or vibrissae of cats. In man the tips of the tongue and fingers are most sensitive, while in the honeybee the tips of the antennae and mandibles are probably the most sensitive. This sense is highly developed in each, but, after considering the work done by bees, it is probably more highly developed in them than in man. The sense of touch in spiders is perhaps the most highly

developed of all. The female orb-weaver at the center of her web can tell friend from foe, male from female of her species, and an insect suitable for food from one not suitable.

The common belief that insects can hear is based on three facts: (1) Many have special sound-producing organs; (2) some have so-called auditory organs; and (3) many of the experimental results obtained indicate that insects can hear, although certainly not as we do. Their hearing may be on no higher plane than that advocated by Forel, who compared this perception in them to that in deaf-mutes who feel the rolling of a carriage at a distance. The auditory sense has recently been discussed by Abbott (*1*) and the writer (*19*).

SUMMARY.

Man is considerably more acute than the honeybee in ability to distinguish differences in brightness. Bees are able to distinguish between two flowers merely by their shapes. The spectrum to man has seven colors, while bees perceive only four colors in a slightly different spectrum. Bees do not see our red of longer wave length, but they do perceive ultra-violet, which we can not see. The first color perceived by bees includes our red of shorter wave length, our yellow, and our green. Their second color corresponds to our blue-green; their third, to our blue and violet; and their fourth includes the ultra-violet, which is beyond our perception. Lepidoptera also perceive ultra-violet. In our spectrum there is only one point of maximum stimulative efficiency, but in the spectrum of bees and *Drosophila* there are two points, one in the yellow-green and one in the ultra-violet. The first closely corresponds to that of man, but the second is four and a half or five times as great as that of the first.

The olfactory organs of vertebrates and insects are dissimilar in structure but more or less similar in function. Civilized man smells poorly in comparison to the extreme acuteness of smell in dogs and bees.

Most writers claim that insects can really taste, but the present writer denies this. In fact their olfactory sense is so acute that they do not need a sense of taste.

The sense of touch in insects and the same sense in vertebrates seem to be similar, but in regard to hearing there is no comparison.

In conclusion, man lives chiefly in a world of sights and sounds, while dogs and bees live mostly in worlds of odors.

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SOME NEW OR LITTLE KNOWN THYSANOPTERA.

By J. C. Crawford.

In this paper there are described four new species of thrips, one of which is of considerable economic importance. I am indebted to various persons for specimens, and credit is given to them in citing material; also to Dr. H. Priesner, Cairo, Egypt, for making comparisons. The types have all been deposited in the United States National Museum, paratypes are in the collection of Dr. Priesner, while other paratypes have been retained in my collection. Studies were made with a compound binocular microscope and measurements with an eyepiece micrometer.

Family Aeolothripidae.

Aeolothrips versicolor Uzel.

This European species, which was determined for me by Dr. Priesner, is added to our fauna from one specimen taken at

Morganville, N. J., on privet or syringa, June 4, 1936 (E. Kostal); one at Demarest, N. J., on linden, July 11, 1936 (J. C. C. and W. S. Fields); many at Alpine, N. J., on leaves of a red oak, May 16, 1937 (J. C. C.), and several, with nymphs, on Mount Hamilton, D. C., on *Rhus glabra*, June 17, 1836 (J. E. Walter). All specimens taken are form *similis* Priesner.

Family Thripidae.

Anaphothrips orchidii Moulton.

Added to the New York fauna from material taken during December, 1936, and January, 1937, in greenhouses in New York City, on leaves of *Pharbitis cathartica* and *Passiflora* sp.

Scirtothrips longipennis Bagnall.

Taken at the same time as the preceding species on leaves of *Pharbitis cathartica* and *Ipomoea batatoides*.

Sericothrips interruptus Hood.

Many specimens taken on birch and hickory leaves, Montville, N. J., July 28, 1935, extend the known distribution and give new records of food plants. The species was previously known from the type material of three specimens from Maryland, one taken on a red oak and two taken in hibernation.

Sericothrips walteri, new species.

Female (macropterous).—Length about 1 mm. Color, by reflected light, light yellow with brown markings on thorax and abdomen; head almost white; by transmitted light, light yellow with brown markings, pterothorax brown with a slightly reddish tinge, abdomen with a slight brownish tinge more distinct apically, antennal segment 1 white, 2 tinged with brown, segments beyond increasingly brownish.

Head retracted in prothorax, apparently about 120 *mμ* long, about 144 *mμ* broad, along front and sides tinged with brown; eyes protruding, cheeks slightly, evenly curved; ocellar pigment bright rust red; anteocellar bristles 32 *mμ* long, interocellars short, on each side of rear margin of front ocellus; inner pair of postoculars 32 *mμ* long, almost back of lateral ocelli; mouth cone about reaching base of prosternum; antennae with segments 3 to 5 pedicellate, 6 only slightly narrowed basally; segment 1 white, 2 tinged with brown, 3 light brown with yellow pedicel, 4 and 5 successively darker brown with basal portion lighter, 6 to 8 darker with base of 6 lighter.

Antennae, Segment No.	2	3	4	5	6	7	8
(*mμ*)	40	46	40	40	48	11	13

Prothorax with concave anterior margin of brown blotch well defined, blotch well marked medially and laterally, leaving 2 irregular lighter spots on disk; transverse anastomosing lines in blotch only rather close and outside of blotch

much farther apart; bristles at posterior angles colorless, 48 mμ long; wings light brownish-gray, darker in second fifth, no accessory bristles in line back of fore vein. Legs yellowish white, with slight brownish tinge laterally on femora and tibiae.

Abdomen with a very broadly interrupted dark-brown line on each side of bases of segments 2 to 6 and a fainter one on segment 7, back of these lines a lighter brown spot, segments 7 to 10 faintly brownish all over; all major setae almost colorless.

Male (macropterous).—Length about 0.8 mm. Very similar to female, in color somewhat more brownish.

Antennae, Segment No.	3	4	5	6	7	8
(mμ)	40	38	36	41	9	12

Type locality.—Along Potomac channel opposite Washington airport, January 9, 1937.

Described from 21 females and 12 males taken under bark of dead elderberry sticks by Mr. John E. Walter, from whom I received the material and in whose honor I take great pleasure in naming this species. Mr. Walter writes that he has taken it throughout the year and in summer in all stages.

Type.—U. S. National Museum No. 52230.

So far as I know this is the first species in this genus, as well as in the family Thripidae, living under dead bark, and in spite of this anomalous habit the species is a normal *Sericothrips* and very closely related to the species living on green leaves.

Of the species of the United States which have dark abdominal markings and no bristles back of fore vein, *pedicellatus* Hd. has the sixth antennal segment pedicellate; *apicalis* Hd. has the anastomosing lines in pronotal blotch very closely spaced and only slightly more widely spaced outside it, antennal segment 3 much longer than 2, segment 6 shorter than 3, about equalling 4; dark line at bases of segments 2 to 7 not interrupted, etc.

Thrips walteri, new species.

Female.—Length about 1.1 mm. Dark chestnut brown, with red hypodermal pigment in thorax and abdomen; antennal segments 1 and 2 concolorous with body, 3 to 5 yellow, darkened apically, 6 to 8 lighter brown than segments 1 and 2, with basal half of 6 brownish yellow; wings deep brown, with hyaline bases and subhyaline apices; femora and bases of tibiae brown, rest of legs yellow; body bristles dark brown.

Head (from in front of eyes) 104 *mμ* long, 160 *mμ* wide, with transverse anastomosing lines; cheeks slightly curved; ocelli in an equilateral triangle, lateral ones remote from eyes, the anterior one about at middle of eyes, so that the inner pair of postocular bristles (22 *mμ* long) are close to and back of middle of postocelli; ocellar pigment bright red; interocellar bristles about on a line tangent to rear margin of anterior ocellus, 24 *mμ* long; anteriad of them and farther apart, a weaker, shorter (16 *mμ*) pair; eyes not protruding, pilose, with

large facets; mouth cone reaching almost across prosternum; antennal segments 1 and 2 dark brown, 2 lighter apically, 3 to 5 pedicellate, yellow, with 4 tinged with brown in apical one-fourth and 5 slightly darker in apical half, 6 and 7 darker but lighter than 1 and 2, with 6 yellowish in basal two-fifths; segments 3 and 4 slightly vasiform at apices, 5 somewhat narrowed apically, 6 with a broad base.

Antennae, Segment No.	1	2	3	4	5	6	7
(*mμ*)	24	40	54	50	40	56	20

Prothorax 116 *mμ* long, 196 *mμ* wide, sides almost straight and subparallel; bristles at posterior angles, outer 80 *mμ*, inner 82 *mμ* long; postmargin with 3 pairs of bristles between postangulars, the inner pair about half as long as postangulars, and twice as long as and much stronger than the 2 outer pairs; a short bristle between each pair of postangulars; disk of prothorax with scattered bristles of which 4 pairs are along front margin; just back (10 *mμ*) of them 2 pairs of larger and stronger (32 *mμ*) bristles, inserted about midway between the outer pair and the second pair from side margin; another pair of similar large bristles (37 *mμ*) along lateral margins, about 48 *mμ* anteriad of postangulars; pterothorax somewhat lighter in color than prothorax and abdomen; wings hyaline in basal one-fourth, deep brown in median one-half, deepest basad and fading out apicad so that apical one-fourth is only very faintly tinged with brown; costal fringe sparse, costal bristles 19 to 21, fore vein with 6 to 7 basal and 2 to 3 (usually 3) apical bristles (1+2); when only 2 bristles apically, the basal one is omitted; hind vein with 9 to 11 bristles; bristles on fore vein brown, except basal 4 which are in hyaline area; the 3 outer basal bristles (2 when there are only 6 basals) in brown area; the outer 2 apical bristles in light apical area.

Abdomen at sides of segments 2–8 with a few transverse anastomosing lines, becoming increasingly diagonal from segment 4 apicad; segment 8 with a short complete comb; bristles on segment 9, inner 100 *mμ*, outer 110 mμ long; on 10th segment 100 *mμ*; segment 10 split open above; no accessory ventral bristles.

Male.—Unknown.

Type locality.—Mount Hamilton, D. C.

Type.—U. S. National Museum No. 52229.

Host.—Leaves of Joe Pye weed (*Eupatorium purpureum* L.).

Described from 19 specimens, taken June 17, 1936, by Mr. John E. Walter.

Mr. Walter, to whom this species is gratefully dedicated, writes that he has collected this species at other times, always on the leaves of species of *Eupatorium*, to which it seems to be confined.

Thrips pallicornis Hd., which has light antennae, has them lighter in color, the antennal formula quite different, with joint 6 distinctly shorter than 3, basal bristles of fore vein nearly confined to hyaline area, legs concolorous with body, wings not hyaline at apices, etc.; *helianthi* Morgan has the wings light brown except basal one-fifth and apical one-fourth, which are light gray, hind vein with 19 to 20 bristles, etc.

Family Phlaeothripidae.

Aleurodothrips fasciapennis Franklin.

Discovered in the greenhouses of the New York Botanical Gardens, where it is abundant, by Mr. G. J. Rau, who first collected specimens on palms among hemispherical and diaspine scales, April 20, 1936.

Gnophothrips piniphilus, new species.

Holotype female (brachypterous).—Length (distended) about 2 mm.; color brownish black, including legs, with tarsi slightly lighter; antennae beyond segment 2 ochraceous, with segment 2 slightly dusky at tip and succeeding segments somewhat darker.

Head almost 1.5 times as long as greatest width, broadest near middle, sides evenly curved from eyes to base of head; vertex slightly produced, with anterior ocellus directed forward; eyes about one-fourth as long as head, not protruding, separated by slightly more than the diameter of an eye; ocelli in an equilateral triangle, posterior ocelli close to eye margin; head with transverse anastomosing lines. Antennae about 1.4 times as long as head; segments 1 and 2 concolorous with head, with segment 2 lighter at apex; segments 3 to 6 ochraceous, with segment 3 slightly dusky at apex, segment 4 brownish in apical fourth, segment 5 brownish in apical two-fifths, 6 brownish in more than apical half, segments 7 and 8 brown with segment 7 lighter just beyond extreme base; segments 3 to 6 pedicellate, segment 7 with a broad pedicel, segment 8 distinctly narrower at base than segment 7 and not closely joined to it; sense cones small, formula: 3, 0–1, 4, 1–2, 5, 1–1 + 1, 6, 1–1 + 1, 7 with 1 on dorsum. Postocular bristles brown, 52 *mμ* long, with slightly dilated colorless tips. Mouth cone reaching almost to prosternum.

Prothorax about 0.67 as long as head and (exclusive of coxae) about one and one-half times as wide as head at point of greatest width, distinctly widened behind, all major bristles present, brown, with slightly dilated hyaline tips; anterior angulars, anterior marginals, mid-laterals, and coxals 24 *mμ* long, outer postangulars 42 *mμ* long, inner 32 *mμ* long; the anterior angulars and marginals rather slender, the others heavy. Pterothorax about as broad as prothorax, including coxae, sides parallel. Wings hyaline, about as long as head (occasional specimens with wings partially developed, with fringed margin and reaching almost to fourth segment of abdomen). Fore tarsi unarmed.

Abdomen, in undistended specimens, somewhat wider than prothorax, in fully distended specimens not distinctly so; 2 pairs of wing-retaining bristles on segments 2 to 6, the anterior pair short and slightly curved, the posterior pair on segments 3 to 6 heavy, doubly arcuate; major lateral bristles brown, mostly blunt. Tube about 0.62 length of head, its basal width 0.42 its length; width at tip about one-half basal width; terminal bristles about 0.8 length of tube.

Antennae, Segment No.	1	2	3	4	5	6	7	8
(*mμ*)	58	56	76	68	62	64	51	32

Allotype male (brachypterous).—Length (distended) about 1.75 mm. Similar to female, color somewhat more brownish than in female, brown markings on distal antennal segments somewhat darker; wings about one and one-half times as long as head; tarsi unarmed.

Antennae, Segment No.	1	2	3	4	5	6	7	8
($m\mu$)	48	58	72	68	60	64	56	36

Female (macropterous).—Length (distended) about 2 mm. Wings not narrowed medially, entirely hyaline, reaching, in distended specimens, about to seventh abdominal segment, no double fringe hairs.

Antennae, Segment No.	1	2	3	4	5	6	7	8
($m\mu$)	48	64	86	84	68	66	56	32

Male (macropterous).—Length about 1.32 mm. Wings reaching almost to apex of eighth abdominal segment.

Antennae, Segment No.	1	2	3	4	5	6	7	8
($m\mu$)	48	58	72	68	60	64	56	32

Type locality.—Near Patchogue, Long Island, N. Y., July 19, 1937 (types), collected by the author and Messrs. Clement, Tank, and Morgan; July 13, 1937 (type *forma macroptera* male and paratypes collected by J. R. Tank).

Additional locality.—Peacedale, R. I., June 1, 1935, J. A. Thompson collector (1 male, 1 female, brachypterous).

Type.—U. S. National Museum No. 52231.

Described from a great number of specimens, mostly brachypterous, taken on *Pinus* sp. (probably *niger* variety).

Differs from the description of *Gnophothrips megaceps* Hd. in the slightly darker antennae with longer segments, in having the head about one and one-half times as long as broad, in having major setae of head and thorax dilated at apices, in antennal segments 7 and 8 not being closely united, in having the tube very distinctly more than half as long as head, and in having the prothorax very distinctly broadened posteriorly.

This species was first received through the Division of Insect Identification, Bureau of Entomology and Plant Quarantine, which sent the specimens from Rhode Island for determination. This year Mr. J. R. Tank of the New York State Department of Agriculture brought in material from nursery stock near Patchogue collected on July 13, 1937; and on July 19, through the kindness of Messrs. R. L. Clement, J. R. Tank, and R. P. Morgan, all of the New York State Department of Agriculture, I was taken to see these nurseries and obtained additional material.

The species is doing a great amount of damage to what different nurserymen call Austrian, black, or Japanese black pine, most of the trees in a large block of these pines having all

of the needles on this year's growth stunted to about 1 to 1½ inches in length or those near the base of this year's growth entirely absent. From the growing tips of a single branch as many as 25 to 30 adults could be shaken in addition to very many nymphs and pupae. At one point native scrub pine adjoining the infested pines showed no signs of injury nor could any of these thrips be found on them.

Haplothrips (Xylaplothrips) subterraneus, new species.

Female (macropterous).—Dark brown or blackish brown, antennae concolorous, with pedicel of joint 3 yellow and joints 3 to 6 lightened at base; tube lighter at apex; legs concolorous, fore femora in apical 3d, bases and apices of mid and hind tibiae, and all tarsi yellow or slightly tinged with brown, fore tibiae yellowish, medially tinged with brown; fore wings basally deep brown, rest of fore wings and hind wings slightly tinged with brown; hind wings in basal half with a dark streak.

Length (distended) 2 mm. General color dark brown, including legs, but with fore femora at apices and all tibiae at bases and apices yellowish; fore tibiae only lightly darkened medially. Head: Length 232 *mμ*, width 187 *mμ*, length from front of eyes 197 *mμ*, eye length 87 *mμ*. Antennal segments 1 and 2 concolorous with head, remaining segments lighter brown, with bases of segments 2 to 6 yellowish; head with anastomosing transverse lines; fore ocellus directed anteriorly; a pair of short (15 *mμ*) postocellar bristles, another similar pair in front of lateral ocelli, and a shorter pair close to and on a line with posterior margin of anterior ocellus; lateral ocelli 18 *mμ* in diameter; postoculars knobbed, 94 *mμ* long; sides of head very slightly convex and slightly narrower behind and very slightly necklike; mouth cone broadly rounded, very short, reaching about one-third across prosternum. Antennal segment 1 very broad, tapering to tip, where it is about as broad as greatest width of segment 2; segment 3 obconical, symmetrical; 4 and 5 with sides almost evenly rounded, 6 slightly obconical, 7 cylindrical, 8 acute, with base slightly narrowed; segments 3 to 7 pedicellate; antennal sense cone formula: 3, 1–2, 4, 2–2+1, 5, 1–1+1, 6, 1–1+1, 7, 1 dorsally; accessory sense cone on fourth segment situated about midway of segment on outer side, curved; accessory sense cones of segments 5 and 6 in normal position; outer sense cone of segment 6 only slightly thicker than antennal bristles.

Antennae, Segment No.	1	2	3	4	5	6	7	8
(*mμ*)	36	51	60	64	57	47	43	36

Total length of antennae (distended) 404 *mμ*.

Prothorax 120 *mμ* long, width, including coxae, 330 *mμ*; anterior marginals minute; coxal bristles pointed, other major bristles slightly dilated at tips; prothoracic bristles: anterior angulars, 72.5 *mμ*, midlaterals, 90 *mμ*; postangulars, outer, 166 *mμ*, inner, 94 *mμ*; coxal, 44 *mμ*; wings only slightly narrowed medially, with 5 to 8 accessory fringe hairs, usually 6 or 7. Front femora with numerous short bristles, those within at base shorter and darkened, spinelike; fore tarsi with small tooth.

Abdomen with segments 2 to 7 with 2 pairs of wing-retaining bristles, the posterior pair strongly doubly arcuate, 62 *mμ* long, the anterior pair shorter and not so strongly doubly arcuate. Segments with transverse anastomosing lines, almost reticulate; major spines pointed; tube: length 152 *mμ*, basal width 73 *mμ*, apical width 36 *mμ*. Abdominal bristles: on ninth segment, inner 163 *mμ*, outer, 181 *mμ*; on apex of tenth segment, 145 *mμ*.

Male (macropterous).—So similar to female as to require no special description; fore tarsal tooth only slightly larger than in female.

Antennae, Segment No.	1	2	3	4	5	6	7	8
(*mμ*)	36	48	60	64	56	48	42	38

Type locality.—England.

Type.—U. S. National Museum No. 52228.

Host.—Lily bulbs.

Described from many specimens taken at New York, N. Y., Oct. 6, 14, and 26, 1936, by Inspectors R. Shemin, R. W. Woodbury, and M. A. McMaster of the Bureau of Entomology and Plant Quarantine.

This species was taken in company with many *Liothrips vaneeckei* but was usually found in more decayed sections of the bulbs.

Of the species in Dr. Priesner's Revision of the Indo-Malayan Haplothrips[1] this species comes nearest *sororculus* Schmutz, *pictipes* Bagn., and *inquinatus* Karny.

H. pictipes Bagn. (said probably to be identical with *sororculus* Sch.) is smaller (1.2–1.3 mm.) with yellow tibiae, more or less shaded gray-brown; antennal segment 3 yellow touched with gray-brown in distal half, with 2 sense cones, head about as broad as long; apical bristles longer than tube, those on segment 9 0.6 tube length; *inquinatus* Ky. is smaller, with head length 156 (173) *mμ*, width 138 *mμ*, eye length 67 *mμ*, antennae 295 *mμ* long, prothoracic postangulars 45–48 *mμ*; bristles on 9th segment 85–90 *mμ*, at apex of 10th 140 *mμ*; tube 100 *mμ* long.

The European *fuliginosus* Schille has antennal segments 3 and 4 with only 2 sense cones.

I am indebted to Dr. Priesner for giving me the generic assignment of this species and stating that it was new; paratypes have been placed in his collection.

Liothrips umbripennis Hood.

Added to the New York list from one specimen taken at Sunken Meadows, Long Island, N. Y., on oak leaves, October 11, 1935 (J. C. C.) and to the New Jersey list from two specimens taken at Alpine on oak and pine by the author and many speci-

[1] Rec. Indian Mus., Vol. 35, p. 365 et seq. 1933.

mens taken at Denville, July 14, 1937, on chestnut oak by Mr. M. H. Sartor, who states that they were so numerous as to curl the leaves.

Rhynchothrips debilis Hood.

The food plant of this species is sweet fern (*Comptonia peregrina*) and this thrips has been taken commonly at Gibson, Long Island, N. Y., by the author from May 30 to August 1, only in the macropterous form.

Symphyothrips punctatus Hood and Williams.

Also established in the New York Botanical Gardens greenhouses, where it was first collected by Mr. G. J. Rau.

A NEW ANOBIID BEETLE (COLEOP : ANOBIIDAE) INJURIOUS TO BOOKS.

By W. S. Fisher,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

Specimens of an unknown anobiid beetle infesting books in Florida were submitted by E. A. Back for identification. It appears necessary to propose new names, both generic and specific, by which this species may be known.

NEOGASTRALLUS, new genus.

Body oblong, moderately convex. Head not visible from above, received in an excavation of the prothorax; front obliquely carinate above the antennae; beneath deeply excavated behind the mentum. Eyes small, widely separated. Antenna 9-segmented; first segment elongate oval; second similar but smaller; third, fourth, and fifth very narrow, subequal in width and length, the sides of the third and fourth parallel, the fifth slightly triangular; sixth very small, quadrate, one-half as long as and distinctly narrower than the fifth; seventh and eighth triangular, each as wide as long; ninth oblong, slightly longer than the eighth. Pronotum with lateral margins entire. Anterior and middle coxae widely separated. Prosternal process deeply depressed between the coxae, with the sides parallel. Posterior coxae grooved for the reception of the femora. First and second visible abdominal sternites connate, the first longer than the second at middle but shorter than it at the sides; third, fourth, and fifth sternites shorter, the third and fourth subequal in length, the fifth longer. Legs slender; anterior tibiae unarmed externally; tarsi nearly three-fourths as long as the tibiae.

Genotype.—Neogastrallus librinocens, new species.

This genus belongs to the tribe Anobiini, and is related to *Gastrallus* Jacquelin du Val, but it differs from that genus in

having the anterior margin of the thorax entire between the anterior coxae, the underside of the head deeply excavated behind the mentum, and the lateral margins of the pronotum entire.

Neogastrallus librinocens, new species.

Uniformly dark reddish brown (legs and antennae slightly paler), moderately shiny, sparsely clothed with short, recumbent, grayish pubescence. Head deeply sunk within the prothorax, the eyes partially covered in repose; front slightly convex, finely, densely granulose. Pronotum wider than long, narrower at apex than at base, widest near base; sides arcuately rounded when viewed from above; disk strongly, uniformly convex; surface rather densely granulose, the granules distinctly separated. Elytra twice as long as wide, subequal in width to thorax at base; sides nearly parallel anteriorly, slightly expanded behind the middle; apices separately broadly rounded; disk strongly convex; surface finely, uniformly, confluently ocellate-punctate; each elytron with a distinct stria along lateral margin, the stria obsolete toward apex. Body beneath finely, densely granulose, the sternum more or less ocellate-punctate. Length, 2.4 mm.; width, 1.2 mm.

Type locality.—Saint Leo, Pasco County, Fla.

Type and paratypes.—No. 52607, United States National Museum.

Described from nine specimens (one type). The adults together with live larvae were found in numbers infesting books received from the Saint Leo College on November 15, 1937.

EIGHT NEW SPECIES OF WEST INDIAN CHRYSOMELIDAE.

By Doris H. Blake.

Five of the species here described were collected by P. J. Darlington during the summer of 1936, in the mountains of Oriente Province, Cuba. Two others from the Museum of Comparative Zoology collection were taken by W. M. Mann in Haiti, and the last is a species from the United States National Museum collection labelled as new by E. A. Schwarz some years ago.

Chalcosicya rotunda, n. sp.

Fig. 7.

About 2 mm. long, broadly ovate, shining with a coppery lustre, sparsely and not regularly sprinkled with whitish scalelike hairs.

Head inserted well into the prothorax, with rounded occiput and front unbroken to the labrum except for a slight median depression on vertex; coarsely punctured, the intervals alutaceous, each puncture with a coarse whitish hair,

almost squamulose. Mouthparts reddish yellow. Antennal sockets large. Antennae about half the body length, two basal joints yellowish, rest yellowish or reddish brown; 1st and 2d joints longer and stouter than 3d–6th joints, 3d–6th joints slender and about equal in length, 7th–11th joints much stouter. Prothorax about twice as wide as long with arcuate sides and narrow margin; alutaceous but shining with a coppery lustre, distinctly but not very densely punctate, each puncture bearing a long white scalelike hair. Scutellum small, rounded and polished. Elytra with prominent humeri, moderately convex and smoothly rounded, without depressions, coarsely but not densely punctate, the punctures particularly near the suture and at apices suggestive of striation, the punctures below the humeri larger and deeper; pubescence consisting of rather scanty coarse white erectish hairs forming a pattern on elytra, the hairs not present on area between the humeri and suture and in the middle of the elytra; surface shining with coppery, often rosy lustre, not alutaceous. Body beneath dark, alutaceous but somewhat shining, with coarse white not very dense pubescence; mesosternum broad, very polished, without hairs, space between the anterior coxae broad and with coarse punctures and hairs; no emargination of episternum below head. Legs deep reddish brown with coppery glints on femora, conspicuously but not densely covered with white hairs. Femora not toothed, claws with a small inner tooth. Length 2–2.8 mm., width 1.3–1.8 mm.

Type.—male and 9 paratypes, U. S. N. M. Cat. No. 52307. Twelve paratypes in the Museum of Comparative Zoology, Type No. 23153.

Type locality.—Pico Turquino, Oriente Province, Cuba, alt. 3000–5000 ft., collected July 20, 1922, by S. C. Bruner and C. H. Ballou, and in June, 1936, by P. J. Darlington.

Remarks.—*C. rotunda* is about the size of *C. nana* but much less densely covered with hairs and with less dense elytral punctation. The pubescence also differs in not being closely appressed but rather erectish.

Chalcosicya costata, n. sp.

Fig. 9.

Oblong oval, about 2.5 mm. long, of shining coppery color, covered with white, closely appressed coarse pubescence, each hair proceeding from a puncture, punctures much coarser on elytra than on head or prothorax, traces of two median ridges on elytra.

Head entirely brown, shining beneath the short white hairs; finely and not densely punctate. Front with a faint median depression, otherwise smooth. Antennal sockets large, antennae reddish brown and about half the length of body, first two and last five joints stouter than intermediate ones, 2d joint much longer than 3d, 3d–6th joints very slender and about equal. Prothorax a little over 1½ times as wide as long, with narrow margin and arcuate sides, moderately densely and distinctly punctate with a short, closely appressed white hair from each puncture. Scutellum punctate and with one or two hairs. Elytra with well marked humeri and much coarser punctures than prothorax, punctures

confused; hairs short, appressed and not concealing the coppery lustre. Traces of two irregular median ridges more marked near base and not extending beyond apical narrowing. Body beneath and legs entirely deep reddish brown, coarsely punctate and with white, closely appressed pubescence. Anterior femora with a tiny tooth. Length 2.4–2.7 mm., width 1.5–1.7 mm.

Type.—male and 1 paratype U. S. N. M. Cat. No. 52308.

Type locality.—Nueva Gerona, Isle of Pines, collected by G. Lenk, May 31, 1912.

Remarks.—This species differs from *C. rotunda*, *nana* and *maestrensis* by having a small tooth on the anterior femora. Some species of *Metachroma* have a similar tooth. The faint irregular elytral ridging well distinguishes this species.

Chalcosicya ditrichota, n. sp.

Fig. 10.

Oblong oval, about 3 mm. long, shining with a coppery, aeneous, or even bluish lustre and with a conspicuous but not dense coarse white pubescence intermixed on the upper surface with a finer and inconspicuous erectish dark pubescence; densely punctate.

Head lustrous beneath the coarse white pubescence that covers the upper part except the front, the front bare, showing dense, coarse punctation; upper part of head without grooves or prominences, a slight median vertical depression; mouth-parts reddish or yellowish brown. Antennal sockets large, antennae extending below humeri; first two and last five joints stouter than 3d–6th joints, which are slender and approximately equal; first two or three joints and 7th and sometimes 8th paler. Prothorax not quite twice as wide as long, with narrow margin and arcuate sides; surface shining, densely punctate and covered with coarse white hairs and finer dark hairs. Scutellum with a few punctures and sometimes a few hairs. Elytra with prominent humeri, lustrous, densely and more coarsely punctate than prothorax, not densely covered with an irregular coarse white pubescence forming a pattern and with an inconspicuous finer, longer and more erect dark pubescence. Body beneath and legs with dense white pubescence. Body dark, legs a little paler; sometimes yellowish; anterior femora with a tiny tooth. Length 2.2–3.4 mm., width 1.4–2 mm.

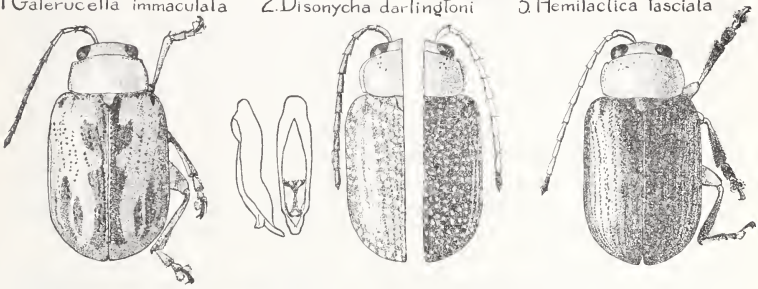
Type.—male and 8 paratypes in the Museum of Comparative Zoology, Type No. 23154.

Type locality.—Buenos Aires, Trinidad Mts., 2500–3500 ft., Cuba, collected May 8–14, 1936, by P. J. Darlington. Two other specimens were collected by Darlington, one at San Blas and vicinity, Trinidad Mts., alt. 1000–3000 ft., on May 9, 1936, the other on Pico Turquino at 5000–6000 ft, in June, 1936.

Remarks.—*C. ditrichota* is larger and more oval than *C. rotunda* or *nana* and is smaller and with longer pubescence than *C. maestrensis*. As in *C. costata*, the anterior femora are toothed. The presence of two kinds of pubescence is its most striking character.



1 Galerucella immaculata 2. Disonycha darlingtoni 3. Hemilactica fasciata



4. Blepharida haitiensis 5. B. irrorata with spots 6. B. irrorata without spots



7. Chalcosicya rotunda 8. Paratrikona ovata



9. Chalcosicya costata 10. Chalcosicya ditrichota

Galerucella immaculata, n. sp.

Fig. 1.

Oblong oval, about 5 mm. long, pale yellow brown without trace of elytral markings, feet and last six antennal joints and apices of all but the basal dark brown.

Head pale with dark mouthparts and a dark median line down front; densely covered with pale appressed pubescence. Antennae not extending to the middle of the elytra, 2d joint half the length of 3d, which is the longest, joints 4–8 very gradually diminishing in length, all of them lightly pubescent; basal joint pale, joints 2–6 pale with dark brown apices, joints 7–11 dark. Prothorax twice as wide as long, widest a little before the middle, thence deeply incurved, a nodule at anterior and posterior angle; disk widely depressed on sides and with a smaller median depression; entirely pale, coarsely and shallowly punctate and covered with short, fine pubescence. Elytra much wider than prothorax, with prominent humeri, a faint transverse depression before middle and before apical narrowing; densely and rather coarsely punctate and covered with a very fine short pubescence; two median ridges more or less apparent from base to apical narrowing. Body beneath pale and finely pubescent. Legs pale with apices of femora, tibiae, and tarsi deeper brown. Length 5–5.3 mm., width 2.4–2.7 mm.

Type.—male and one paratype in the Museum of Comparative Zoology, Type No. 23155.

Type locality.—Mountains north of Imias, eastern Oriente Province, Cuba, alt. 3000–4000 ft., collected July 25–28, 1936, by P. J. Darlington.

Remarks.—Of all the species of *Galerucella* described from the West Indies this appears to be the only one without dark elytral markings.

Blepharida haitiensis, n. sp.

Fig. 4.

Oblong oval, 5 mm. long, 2.8 mm. wide, shining, pale yellow brown with dark sutural and semi-vittate lateral markings and 10 broken rows of striate punctation on elytra.

Head pale except for deep brown tips of mandibles, smooth, shining, without interantennal prominences or distinctly marked frontal tubercles; a shallow groove running upward from antennal base to eye; interocular space over half as wide as head. Antennae extending not quite to the middle of the elytra, deepening to darker brown from 4th to apical joints, 3d shorter than 4th joint. Prothorax approximately twice as wide as long, a little convex, arcuate at the sides, smooth, polished, nearly impunctate except for a short row of fine punctures on either side near the anterior margin below the eye; entirely pale yellow brown. Scutellum pale. Elytra with well defined humeri and a slight swelling behind each humerus near the lateral margin; parts of 10 rows of striate punctures none of which is entire, the punctures being particularly deep and distinct near the suture; intervals between not costate; pale yellow brown with a broad sutural vitta not reaching the apex and widening and curving upwards in basal half, also three lateral vittae of different lengths on apical half of each elytron. Body

beneath shining and pale except for the sides of the breast, which are deep brown. Legs pale with darker brown joints, all tibiae with a small spur; claws toothed.

Type.—Female in the Museum of Comparative Zoology, Type No. 23156.

Type locality.—Cape Haitien, Haiti, collected by W. M. Mann.

Remarks.—So far, only two species of *Blepharida* are known to occur in the West Indies, *B. irrorata* Chev. from Cuba, and *B. haitiensis*, of which only a single specimen has been examined by the writer. The striate punctation usual in the genus is in this species represented only by the broken rows of punctures. There is likewise only a fine row of punctures visible on the prothorax behind the eyes.

Blepharida irrorata Chevrolat.

Figs. 5 and 6.

Revue et Magazin de Zoologie, ser. 2, vol. 16, 1864, p. 182.

Chevrolat described *Blepharida irrorata* as yellow with black antennae and black tibiae and tarsi and with fuscous elytra thickly spotted with white. There appears to be considerable variation in size and coloring in this Cuban species, and some specimens are so unlike the typical as to lead to confusion. The aedeagi in all specimens examined, however, are indistinguishable.

P. J. Darlington has collected a series at Soledad in April, 1936, many of which correspond with the original descriptin in every way but size. Some of his specimens are barely 5 mm. long in contrast with 10 mm. of Chevrolat's description. The antennae in some of the Soledad specimens are pale yellow, in one yellow with a dark apical joint, in others the antennae vary from light brown to black. The elytra likewise vary from pale yellow to deep brown with pale spots. In the darker specimens the breast is deep brown. Specimens collected at Central Jaronu, Tobabo and Baragua are somewhat larger, 6 or 7 mm. long, and have black elytra spotted with white, black breast and pale antennae with a dark apical joint. In a series of 14 in the Academy of Natural Sciences, at Philadelphia, taken 60 miles west of Santiago by H. M. Hiller, 9 have entirely black unspotted elytra, the remainder are finely speckled with yellow. All have pale antennae with a black apical joint and the breast is black. They range from 4.5 to 5.5 mm. long.

Blepharida multimaculata Jacoby.

Described from Atlixco, Tepetlapa, Mexico, and represented by two specimens in the Bowditch collection from Tepetlapa. It is similar in size and markings to the West Indian species,

but the Mexican species has very deep striate punctation and the punctures are in a single and not double line as in *B. irrorata*.

Disonycha darlingtoni, n. sp.

Fig. 2.

Oblong oval, 5 mm. long, shining, pale lemon yellow with entirely black antennae, black tibiae and tarsi and partly black femora, the basal half being pale.

Head shining, smooth, very finely and not thickly punctate, a fovea on either side of vertex near eye; frontal tubercles distinctly marked, interantennal area blunt and little produced; pale yellow except the mandibles, which are piceous. Antennae long, extending half way down elytra, entirely black, 3d joint a little shorter than 4th, which is the longest, remainder nearly equal in length. Prothorax nearly 1½ times as wide as long with arcuate sides; entirely pale, polished, without punctation. Elytra with well-marked humeri, shining, pale, very finely punctate. Body beneath pale, very faintly pubescent; basal half of all the femora pale, the rest of the legs black. Length 5 mm., width 2.5 mm.

Type.—male in the Museum of Comparative Zoology, Type No. 23157.

Type locality.—The south side of Pico Turquino, Oriente Province, Cuba, 3000–5000 ft., collected in June, 1936, by P. J. Darlington.

Remarks.—The description of *Galleruca pallens* from the island of Guadeloupe by Fabricius in 1792 applies in nearly all points to the present species, but Fabricius' species has the antennae pale at the base and has pale femora. *D. antennata* Jac., which occurs in Central America and at the tip of Florida, differs from the Fabrician species in not having black tibiae. *D. darlingtoni* is related to *D. antennata* Jac., but is smaller and more slender than that species and has entirely black antennae, which are noticeably longer, and differently colored legs. The aedeagus is also different.

Hemilactica fasciata, n. sp.

Fig. 3.

Oblong oval, about 2.5 mm. long, shining, reddish brown with a dark blue basal spot on elytra spreading from the lateral margin nearly to the suture and a transverse band across lower half. Elytra costate.

Head shining reddish brown with yellow labrum and brown mandibles; front and occiput coarsely punctate. Antennae extending fully halfway down elytra, 3d joint shorter than 4th, 4th–8th joints long and diminishing slightly in length; basal joint pale yellow brown, rest dark brown. Prothorax 1½ times wider than long with sides nearly straight; traces of an obsolete transverse basal sulcus marked by a depression on either side and one in the middle, also a fovea on either side anterior to the middle; surface finely and sparsely punctate, shining reddish brown. Scutellum reddish brown. Elytra shining, a broad basal spot of

deep blue extending transversely from the margin nearly to the suture and down about a quarter of the length of the elytra, and a fascia of the same color just below the middle covering all but the extreme apex, a costa extending from humerus to apical narrowing and 4 others more or less distinct but not so long on each elytron; between these median costae a trace of obsolete striate punctation. Body beneath reddish brown, legs the same color with the tibiae and tarsi a little deeper brown like the antennae. Length 2.4 mm.; width 1.2 mm.

Type.—male in the Museum of Comparative Zoology, Type No. 23158.

Type locality.—Upper Ovando R., eastern Oriente Province, Cuba, alt. 1000–2000 ft., collected July 17–20, 1936, by P. J. Darlington.

Remarks.—*Hamilactica fasciata* resembles the other species of *Hemilactica* in its reddish brown color and in the general style of its elytral markings. In this case, the spots take the form of two dark bands, one basal, the other covering all but the tip of the apical half. There is a trace of a sulcus at the base of the prothorax and the costation of the elytra is even more marked than in the species already described. The prothorax is longer than in the other species. The aedeagus is somewhat like that of *H. pulchella.*

Paratrikona ovata, n. sp.

Fig. 8.

Ovate and widest a little below elytral humeri, 7 mm. long, above yellowish with large irregularly placed, chestnut brown elytral punctures; head, body and femora deep brown to piceous, tibiae and tarsi golden brown, antennae pale with apical joint dark; a double hump on elytra.

Head not visible from above, black, front declivous, deeply inserted in prothorax, with a deep emargination on the prosternum opposite the eye, thereby forming a sharp tooth on lower side of eye. Antennae pale yellow to penultimate joint, 10th joint slightly darker, apical joint deep brown, 3d joint much thinner and about the length of 2d, 4th long, 5th shorter than 4th or 6th, joints 6–11 thicker but not longer than 4th and covered with short dense hairs. Prothorax not emarginate over head, widest before the middle, basal margin sinuate; disk irregularly bumpy and not very convex, with an explanate hyaline margin in front and on sides. Surface with coarse dense punctures; yellowish or reddish brown, somewhat deeper in coloration than the impunctate portions of the elytra. Scutellum triangular, reddish brown. Elytra with a strongly produced double hump, not lengthened at all into a spine; elytra widest slightly below the shoulder with a forwardly prolonged hyaline margin that extends to the widest part of the prothorax, this margin becoming widest before the middle of the elytra, then gradually narrowing to apex; at shoulder and in the middle of the lateral margin a thickening running into the margin; below the middle, smaller thickenings that extend into margin; punctures very large, deep and except for a sutural row along either side of the suture, very irregularly placed;

the basal color of the elytra pale yellow but the punctures a deep chestnut brown, often with a brownish area about them. Body beneath and femora shining piceous with scanty pubescence; tibiae and tarsi pale golden yellow; claws not divergent. Length 7 mm., width 5.6 mm.

Type.—In the Museum of Comparative Zoology, Type No. 23159.

Type locality.—Grande Riviere, Haiti, collected by W. M. Mann.

Remarks.—This species agrees with *Paratrikona*, as defined by Spaeth, in the shorter apical joints of the antennae, the fact that the head is invisible from above, the tooth on the prosternum, the way in which the produced hyaline margin is not greatly narrowed at the shoulders, and in the not divergent claws. It differs, however, in its shape. *Paratrikona*, according to Spaeth, is subtriangular and *Trikona*, ovate. *P. ovata* is midway in shape between *Paratrikona turrifera* (Boh.) and *Trikona humeralis* (Oliv.). It most closely resembles *P. turrifera* (Boh.) but has no spine on the elytra and has less regular and less dense elytral punctation.

SYNONYMY IN THE GENUS PANORPA (MECOPTERA).

By Ashley B. Gurney,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The author (Proc. Ent. Soc. Wash., Vol. 39, No. 8, pp. 222–227, figs. 1–7, 1937) has recently described *Panorpa utahensis*, based upon six specimens the locality labels of which represent three localities in northeastern Utah. *P. venosa* Westwood was also recorded. Because of the unusual nature of a Utah record for the genus *Panorpa*, Dr. F. M. Carpenter requested paratypes of *utahensis* for study and has found that the species must be placed in synonymy. The male of *utahensis* represents *submaculosa* Carpenter and the female *maculosa* Hagen. The author had assumed that the two sexes were of one species and had misinterpreted the published figures of the genitalia of *submaculosa* and *maculosa*. After a comparison of material the above synonymy is clear.

Dr. Carpenter writes that he is skeptical of the accuracy of the records, but Mr. F. C. Harmston, the collector, has reported that he does not believe any error in locality records has occurred. Thus, it may still be possible that three eastern species of *Panorpa* occur in Utah.

RECENT ADVANCES IN ENTOMOLOGY, *Second Edition,* A. D. Imms., 431 pages, 94 illustrations, J. & A. Churchill Ltd., London, 1937.

The text of the second edition of this most useful book adds 57 pages to that of the first edition (1931), and includes 28 new illustrations, 18 of which replace figures of the original edition. The same chapter headings and subdivisions have been retained, and the new matter is inserted at its pertinent place in the body of the text. The principal revisions or additions occur in the chapters on Aspects of Morphology, Sense Organs and Reflex Behaviour, and Practical Applications of Ecology, while the Index of Authors increases from about 280 names in the first edition to 358. The book is more generous in its content than in its title, since each subject begins far enough back in the past to give the reader an intelligible background. For this reason, together with the breadth of the field covered, including such diverse subjects as morphology, metamorphosis, palaeontology, sense organs and reflex behaviour, coloration, ecology, parasitism, and biological control, the book serves as an excellent text on the broader phases of entomology both for the student and for the general reader, who is usually a specialist. Furthermore, while the subject matter is discussed in a purely scientific manner, with no concession to "popularization," the style of writing is clear and explicit throughout, giving concisely the information that the reader is most likely to want on each subject. In short, Recent Advances in Entomology is also a welcome advance in the style of entomological texts. —R. E. S.

A TEXTBOOK OF PLANT VIRUS DISEASES, By Kenneth M. Smith. 8 vo., cloth, 614 pp., 101 figs., Philadelphia, Pa. P. Blakiston's Son and Company. 1937. $5.00.

This book is of value to the entomologist because of its very full discussion of the relation of insects to the transmission of plant virus diseases. The scope of the work as a whole consists of general treatment of the plant virus, its properties, its mode of transmission and the like. This is followed by similar treatment of the diseases caused thereby and these are arranged according to host plant families, such as Delphinium, Gossypium, Ficus, Nicotiana, and Solanum.

A generous portion of the work (chapter 8) is taken up with detailed treatment of some 39 insects, including such matters as food plants, life history, habits and ecology, where concerned in such transmission. Among these are such important forms as *Frankliniella insularis* Fr., *Thrips tabaci* Lind., *Lygus pratensis* Linn., *Piesma* (*Zosmenus*) *quadrata* Fieb., *Cicadula divisa* (*sexnotata* Fall.) Uhl., *Cicadulina mbila* Naude, *Euscelis striatulus* Fallen, *Eutettix tenellus* Baker, *Macropsis trimaculata* Fitch, *Nephotettix apicalis* Motsch., var. *cincticeps* Uhl., and *Peregrinus maidis* Ashm. A feature which adds greatly to ready reference use of the book is an appendix in which all the more common virus disease symptoms are listed together with the virus which causes them, and page reference is appended in each case so that further information is easily accessible. No account is given of the technique and methods of study of the

plant viruses because these matters already have been discussed in another recent book by the same author. "It is hoped," says the author in his Preface, "that the book will lessen the confusion now existing in regard to study of plant diseases, and it will help to give the subject its rightful status as a distinct science." —J. S. W.

A GLOSSARY OF ENTOMOLOGY, by J. R. de la Torre-Bueno, 8 vo. cloth, 336 pp., 9 plates, 28 Clubway, Hartsdale, N. Y., Brooklyn Entomological Society, 1937. $5.00.

The second edition of this work, prepared by John B. Smith in 1906, contained 154 octavo pages, 3 pages of black and white line drawings dealing with structural details, and one plate in color showing the nomenclature of 40 Windsor and Newton water colors. While the second edition contained some 4,300 terms, the present third edition completely revised and rewritten contains nearly 12,000 definitions; and since, in many cases, numerous terms with slightly different spellings have the same definition, nearly 10,000 terms are given. These include not only those strictly within the field of entomology but likewise sciences into which it enters, as embryology, cytology, physiology, morphology, development, genetics, and ecology; and also certain terms in chemistry, physics, botany, medicine and the like, and there are also given a selection from the terminology of medical entomology and from the field of mathematics. Definitions and terms have been freely revised where necessary and most frequently are defined as employed by individual authors, often in their own words, the author's name being given in parenthesis immediately following such use. The modern usage of words as well as their original acceptation is indicated. Plurals are shown, at least in the root term, or as indicated by the originator of the term. The two appendices comprise a list of Latin abbreviations and a list and alphabetical register of arbitrary signs and symbols used in entomology. The bibliography comprises 34 titles ranging in date from 1827 to 1936. Plates 1, 2, and 9 appeared in the second edition, while plates 3 to 8, inclusive, also dealing with structural details, are new. The color plate of the second edition has not been included. —J. S. W.

PRACTICAL BACTERIOLOGY, HAEMATOLOGY AND ANIMAL PARASITOLOGY, by E. R. Stitt, P. W. and M. C. Clough. 9th ed. revised and enlarged, 8 vo., cloth, 961 pp., 208 illus., part in color. Philadelphia, P. Blakiston's Son & Co., 1938. $7.00.

This work, well known and widely used in its previous editions, and now just issued in its ninth revised and enlarged edition, is a comprehensive textbook of modern bacteriology and guide to laboratory methods, and is of particular interest to workers in entomology, not only because of its treatment of topics directly within the field of entomological investigation, but also because of its down-to-date discussion of mites, ticks and other nearly related forms.

Obviously, the scope of this notice must be limited to those sections of the book likely to be of usefulness to students in entomology and in nearly related fields, since it would not be feasible here to give a sufficiently extended general review to be appropriate for a work of such comprehensiveness. In this new ninth edition the portions of the book (chapters XVI to XXV, pp. 533 to 584 inclusive), dealing with insects includes discussion of 49 species and varieties within 41 insect genera. Of these, 3 species are within the Anoplura, 4 within the Hemiptera, 8 within the Siphonaptera and 34 within the Diptera, practically all of these being disease carriers or otherwise directly injurious to man or to the lower animals under varying conditions in various parts of the world. Considerable attention has been given to those intermediary in human infection, and, specifically, those by which it appears possible to transmit yellow fever, malaria, filariasis and dengue. The authors have tried to bear in mind the needs of the research worker in tropical or remote locations where access may not be had to well equipped libraries, particularly as related to the epidemiological importance of species determination and of applicable control measures. Of usefulness also to entomological workers are the sections (appendix, pp. 809 to 875, inclusive), concerning latest apparatus, as microscopes, sterilizers, filters, incubators and the like, as well as those pertaining to culture media, staining methods, the preservation of tissues for examination in microscopic sections, and the mounting and preservations of various kinds of biological material. Mention also should be made that the very considerable portions of the volume dealing with toxic plant products and on communicable diseases have been greatly extended over previous editions, while that on filterable viruses (chapter IX, pp. 167 to 201, inclusive), is almost entirely new. —J. S. W.

MINUTES OF THE 488TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 488th meeting of the Society was held at 8 P. M., Thursday, January 6, 1938, in Room 43 of the National Museum, with thirty-nine members and eight visitors present, and President Back presiding. The minutes of the previous meeting were read and approved.

The President announced the appointment of D. G. Hall, E. C. Cushing and H. H. Richardson to the Program Committee, and F. W. Poos, Alan Stone and H. S. McConnell to the Membership Committee.

The following members outlined the important features of the various sessions of the Annual Meeting of the American Association of Economic Entomologists held at Indianapolis:

General Session . . . . . F. C. Bishopp
Apiculture . . . . . S. B. Fracker
Quarantine . . . . . E. R. Sasscer
Extension . . . . . M. P. Jones

Dr. Bishopp spoke in place of J. A. Hyslop, who was unable to be present. E. C. Cushing had originally intended to discuss the General Session, but was unable to do so. Brief notes on the Annual Meeting of the Entomological Society of America were given by A. B. Gurney, speaking in place of R. E. Snodgrass.

The main part of the program was devoted to the address of the retiring President, N. E. McIndoo, entitled "Sense organs of insects compared to those of higher animals." Dr. McIndoo's address, which will appear in published form, was commented upon by W. H. Anderson.

Adjournment at 10.10 P. M.

Ashley B. Gurney,
Recording Secretary.

Actual date of publication, February 24, 1938.

ANNOUNCEMENT

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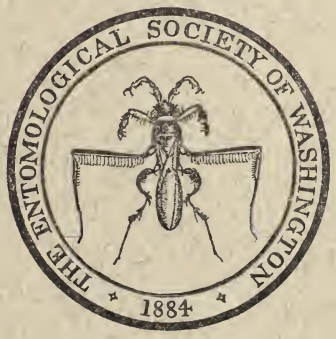
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PROCEEDINGS OF THE

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A SYNOPSIS OF THE ORDER ZORAPTERA, WITH NOTES ON THE BIOLOGY OF ZOROTYPUS HUBBARDI CAUDELL.

By Ashley Buell Gurney,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

One of the most interesting orders of insects, both from the standpoint of the biologies of the species and from the nature of their morphological structures, is the Zoraptera. Although Zoraptera occur in four continents, including both Old and New Worlds, only 16 species are known, of which 4 are here described as new. The writer has recently had opportunity to study the biology of the species common about Washington, D. C., *Zorotypus hubbardi* Caudell, and certain additions to the previous knowledge of the life history have resulted. Very little has been recorded concerning the internal anatomy and male genitalia; and since these are of great interest, the latter being especially valuable for purposes of identification, it seems desirable to bring together in one report the important facts regarding this group of insects.

The writer is especially grateful to R. E. Snodgrass for assistance with the morphological work, but for any interpretations which may later prove to be incorrect the author is to be held solely responsible. H. S. Barber, J. C. Bridwell, and H. E. Ewing have contributed many helpful suggestions, and the notes and other materials assembled by the late A. N. Caudell have been of great value.

No species have been available for study except those described by Caudell and those described in this paper, but since these comprise 9 of the 16 known species, and other species are known from only a very few specimens, a more complete representation could hardly be found at present.

Only a single genus, *Zorotypus* Silvestri, of the family Zorotypidae, is known. The genus *Menonia* George appears to have been incorrectly assigned to the Zoraptera and is discussed in the latter part of this paper.

DIAGNOSTIC CHARACTERS OF THE ZORAPTERA.

The characters defining the group have required little modification since Silvestri's original work (1913) except for a provision for a winged form. They are briefly as follows:

Head capsule and mouthparts orthopteroid; maxillary palpi five-segmented; labial palpi three-segmented. Antenna moniliform, nine-segmented. Paired compound eyes and three ocelli present or absent. Prothorax well developed. Wings present or absent; when present, venation poorly developed; capable of being shed by means of indefinite basal sutures. Legs adapted for running. Hind femur often with heavy spines on ventral margin. Tarsus two-segmented, second segment much longer than the first. Paired curved claws on apical segment of tarsus. Abdomen simple; posterior segments of male often with specialized structures. Male genitalia either symmetrical or asymmetrical. Cerci present. Paurometabolous.

Apparently there are but two fundamental types of individuals as follows:

1. Winged individuals, including sexually functional males and females, which usually shed their wings within a few days after becoming mature. The shedding occurs without help from other members of the colony and there is no evidence of a social life. The body is darkly pigmented and there are compound eyes and three ocelli. The antennae are nine-segmented. The nymphs which develop into this form have small compound eyes and ocelli; the latter may not be visible in the early instars. The antennae are eight-segmented. Later the ocelli become conspicuous, the eyes more prominent, the wing pads become elongate, and the antennae nine-segmented. The egg is similar in external appearance to that of an apterous female.

2. Wingless individuals, functional in both sexes, which never have ocelli. Traces of degenerate compound eyes are visible in occasional individuals, as reported by Caudell (1920, p. 88) and also noted by the writer. The body is distinctly sclerotized, but is not nearly so deeply pigmented as in the winged form. The antennae are nine-segmented and the male genitalia do not differ from those of winged males. Nymphs have eight-segmented antennae and lack eyes, ocelli, and wing pads. In the later instars nine antennal segments are present. No true social life is evident. Much more numerous than winged form.

What determines which of the two forms will develop from a given egg and many other details of the life history are still unknown.

The Genus **ZOROTYPUS** Silvestri.

Zorotypus, Silvestri, Boll. Lab. Zool., Portici, Vol. 7, pp. 196–205, 1913. (Genotype, *Z. guineensis* Silvestri, by original designation.)

The following key to the species is purely artificial and the species *neotropicus* Silvestri (Costa Rica) and *buxtoni* Karny (Samoa) are omitted because of insufficient data. They are discussed in the systematic treatment, however. The most

reliable characters for the recognition of species are found in the male genitalia, but it has been possible to utilize these features to only a limited extent because the male genitalia of but five species are known. In both species of which fair-sized series are available, *hubbardi* and *snyderi*, variation is exhibited by the spines on the posterior ventral margin of the hind femur. This character is sufficiently distinctive, however, to aid in separating the species.

KEY TO THE SPECIES OF ZOROTYPUS.

1. Cercus very elongate, shaped as in fig. 26 (Jamaica) *longicercatus* Caudell
   Cercus roughly oval in outline, of the type illustrated in fig. 7, sometimes prolonged apically into a sharp spine-like process 2
2. Two or three spines among those on the posterior ventral margin of hind femur noticeably longer and stronger than the others (figs. 5, 23, 30 and 34) 3
   Spines on hind femur sub-uniform in size or more than three or only one are noticeably longer and stronger than the others (figs. 28, 42, 55) 7
3. Ventral margin of hind femur with two prominent spines at middle (fig. 5); apex of male abdomen either as in fig. 7 or as in fig. 45 4
   Hind femur not as in fig. 5; apex of male abdomen, where known, not as in figs. 7 or 45 5
4. Male abdomen specialized as in fig. 7; genitalia as in fig. 2 (Eastern and Southern U. S.) ..... *hubbardi* Caudell
   Male abdomen specialized as in figs. 45 and 47; genitalia as in fig. 44 (Matto Grosso, Brazil) ..... *shannoni*, new species
5. Hind femur with two enormously developed spines (fig. 34); terminal abdominal structures and genitalia of male as illustrated (figs. 35–39) (Cocos Island) ..... *barberi*, new species
   Hind femur not so heavily armed (figs. 23, 30); male specialization, where known, not as in figs. 35–39 6
6. Hind femur as in fig. 23, varying as in figs. 17–21 (terminal abdominal structures and genitalia of male as in figs. 11, 12, and 22) (Florida and Jamaica) ..... *snyderi* Caudell
   Hind femur as in fig. 30 (West Africa) ..... *guineensis* Silvestri
7. Hind femur as in fig. 28; apex of male abdomen as in fig. 27 (Southern Sumatra) ..... *caudelli* Karny
   Spines of hind femur not as in fig. 28; apex of male abdomen, where known, not as in fig. 27 8
8. Hind femur as in fig. 46; terminal abdominal structures and genitalia of male as in figs. 44–45 or figs. 2, 6, and 7 9
   Hind femur not as in fig. 46; male specialization, where known, not as above 10
9. Apex of male abdomen as in fig. 45 (Matto Grosso, Brazil) ..... *shannoni*, new species
   Apex of male abdomen as in fig. 7 (Eastern and Southern U. S.) ..... *hubbardi* Caudell

10. Hind femur as in fig. 50 (Apex of male abdomen as in fig. 54) (Guatemala) ..... *cramptoni*, new species
    Hind femur not as in fig. 50 11
11. Hind femur rather strongly armed, spines definitely of contrasting sizes (fig. 42) (Hawaii) ..... *swezeyi* Caudell
    Hind femur less heavily armed (fig. 55) or with spines less contrasting (fig. 25) 12
12. Second segment of antenna subequal to the first; hind femur as in fig. 25 (Mentawei Island, East Indies) ..... *silvestrii* Karny
    Second segment of antenna very noticeably shorter than the first; hind femur with armature different from that in fig. 25 13
13. Hind femur with several weakly developed spines along basal half of ventral margin (fig. 55) (Philippine Islands) ..... *philippinensis*, new species
    Spines arming hind femur not noticeably weaker along basal half 14
14. Cercus prolonged into a sharp spine-like process, with a trace of annulation at its junction with main body of cercus (Java) ..... *javanicus* Silvestri
    Cercus not prolonged into a spine-like process, terminating in the usual seta, no trace of annulation 15
15. Cercus with two strong lateral setae at apex, in addition to terminal seta (Bolivia) ..... *manni* Caudell
    Cercus with only a prominent terminal seta (Ceylon) ..... *ceylonicus* Silvestri

Zorotypus hubbardi Caudell.

(Pl. I, figs. 1–10.)

Zorotypus hubbardi Caudell, Canad. Ent., Vol. 50, pp. 375–381, 1918.
Zorotypus hubbardi Caudell, Proc. Ent. Soc. Wash., Vol. 22, pp. 84–97, figs. 1–4, 1920.

With the exception of *Zorotypus snyderi* Caudell, from Florida, this is the only species of Zoraptera known to occur in the United States and is readily identified by the characters illustrated, especially the specializations of the male. The two principal spines arming the hind femur are usually trustworthy characters for identification, but even specimens collected at the same time and place are sometimes variable. In all femora examined the proximal one of the two large spines is conspicuously developed, but in a few instances the distal one is scarcely larger than the small spines distad of it. For this reason the species is keyed out in two places. The number of small spines between the two large ones varies from one to three in the series studied, sometimes on opposite sides of the same specimen.

In addition to many records within a 25-mile radius of Washington, D. C., both in Maryland and Virginia, the following are unpublished records of material which has been ex-

amined: Corrigan, Tex., Mar. 14, 1937, J. H. Gayden; Houston, Tex., Oct. 9, 1921, H. E. Ewing; Magnolia, Livingston Parish, La., Feb. 23, 1934, in moist decaying logs, F. E. Lyman; Durham, N. C., May 30, 1937, sawdust pile in Duke Forest, A. S. Pearse and A. B. Gurney. The first collections in the vicinity of Washington, D. C., were from under the dead bark of a chestnut tree at Falls Church, Va., March 4, 1921, by E. A. Chapin. Judging from its present abundance near the District of Columbia and the records from North Carolina, Florida, Louisiana and Texas, the species is probably abundant in the Southern States.

On March 1, 1938, two small collections of *hubbardi* were received from Miss Olive Falls of Chicago. One group of individuals was from a lot taken at Crossette, Ark., April 20, 1937, associated with termites. The termites in which the second lot was found were collected at Evanston, Ill., but the Zoraptera were not discovered until two months later. The Arkansas record is reasonable to expect, considering that the species occurs in Texas and Louisiana. Miss Falls writes that contamination may possibly have occurred in the case of the Illinois material, due to the presence in her laboratory of colonies from other sources, so that Illinois can not be listed at present as a definitely known habitat of *hubbardi*.

Termites are often found with *Zorotypus*, because of the frequent similarity of their habitats. Collections by the writer and others, however, indicate that the association of the two groups of insects is only incidental. Thus, Zoraptera are not true inquilines, as they were thought to be at one time (see Caudell, 1918; 1920, pp. 95-97).

When examined with a binocular microscope, males may be distinguished from females by the presence of processes on the eighth and ninth tergites (figs. 6 and 7) and by a dark transverse area of deeper color at the base of the apical sternite. The genitalia are normally concealed, but are sometimes extruded as in fig. 6. There are two principal clasping organs (fig. 2), one simple, the other very much hooked at the apex. There are two well defined and articulated supporting sclerites as well as several smaller and indefinite sclerites.

Notes on internal anatomy.

The male reproductive system is shown in fig. 8. The testes are white bilobed organs from which the double vasa deferentia lead to a common seminal vesicle. A long tube from the latter extends far posteriorly in the abdomen, where it is held by membrane in close contact with the endophallic structures and ejaculatory duct. The accessory glands comprise two white, elongate, conical organs situated at the base of the ejaculatory duct. Ventrally they are partially concealed by a pouch of

similar shape which receives the tube coming from the seminal vesicle. The exact homologies of the endophallic structures and the location of the gonopore have not been determined. Snodgrass (1937, p. 19) has described the very elongate filaments which are arranged in bundles within the testes and seminal vesicles of many males. They have also been found in the seminal receptacle of females and apparently are the spermatozoa. Some specimens show the spermatozoa more perfectly developed than others and one testis is usually more advanced than the other. Fresh material is rather necessary for satisfactory dissections, and in such material the accessory glands may often be seen through the ventral body wall located in the region of the fourth and fifth sternites. The testes and seminal vesicle are normally located dorsally.

The female reproductive system (fig. 1) consists of two groups of ovarioles, united by lateral oviducts to a common oviduct. The ovarioles are normally four to six in number and contain small eggs in various stages of development. Small masses of fat body are almost always present at the extremities of the ovarioles. The spermatheca or seminal receptacle is connected to the region of the genital chamber by a long slender duct. The wall of the spermatheca is very delicate and usually there are one or more loops of the duct within it. The spermathecae of about half of more than a dozen females examined contained spermatozoa. Deälate females have a reproductive system that is essentially the same as in apterous ones and spermatozoa have been observed in their spermathecae.

The alimentary canal (fig. 4) is of very simple structure. The oesophagus leads directly into the crop and the crop and ventriculus are distended in varying proportions in different specimens, depending upon the contents. The Malpighian tubules are six in number, attached separately at the junction of the mesenteron and proctodaeum, and are long and slender. No deïnite valves constricting the alimentary canal were observed except at the latter junction. Six raised and conspicuous, white "rectal glands" are present.

Description of egg.

The eggs secured by rearing experiments fully confirm the observations of Caudell (1920, pp. 94–95). The egg (fig. 10) is oblong in shape, broadly rounded at each end, and average dimensions are 0.61 mm. in length by 0.32 mm. in width. It is practically colorless when laid but assumes a cream-colored, chalky appearance a few days before hatching. The surface of the chorion is not sculptured, but the outlines of cells are visible and the surface is finely granular and minutely spiculate. The egg has no cap or operculum and is simply deposited without supporting structures of any kind. The fine threads in figs. 9 and 10 are of fungous mycelium. At least three days before hatching a dark line can be seen within the shell. This represents the egg burster, and

after hatching the cast embryo skin always appears as in fig. 9, with a shriveled mass projecting from the slit in the shell and a shield-shaped apical portion which bears the egg burster along a median line. The burster is sharp, angulate at the apex, and blade-like. The break in the eggshell is very uniform in all eggs examined.

Weber (1933, pp. 556–558) has outlined the principal methods of emergence from insect eggs and described some types of bursters. Smith (1922) has described the burster in three species of Neuroptera.

Description of nymphs.

Newly hatched nymph: Antenna eight-segmented; apical segment much longer than the preceding one; subapical segments nearly globose, as broad as long; basal segment about equal to second and third together. No wing pads visible. Body white, setae present. Cercus rather elongate, triangular, terminated by a strong seta. Length of body 1.12 mm., of antenna 0.66 mm.

The number of nymphal stages preceding either the alate or the apterous form is not known. The instar directly preceding the winged adult is characterized by nine-segmented antennae, distinct compound eyes and ocelli, and wing pads extending nearly three-fourths the length of the abdomen. Nymphs have been collected with wing pads scarcely overlapping the abdomen, eight-segmented antennae, no visible ocelli, and eyes represented only by brown spots.

It has been suggested (see Caudell, 1920, p. 88) that nymphs with wing pads may represent brachypterous adults, but the rearing demonstrates that some transform into the winged stage, and it is probable that these nymphs are comparable to the nymphs of other paurometabolous insects.

Observations Regarding the Biology of Zorotypus Hubbardi Caudell.

During the seasons of 1936 and 1937 the writer has had opportunity to observe *hubbardi* under natural conditions in the vicinity of Washington, D. C. The surest method of locating a colony is to search a fairly large pile of sawdust, usually on an old mill site, which has lain for several years or until the wood takes on a dark color, decay is well under way, and warmth is generated at a depth of 2 feet or more. During the summer months *hubbardi* may often be found in a few minutes by turning over slabs or large chips of wood which are partially buried by the sawdust. It is much easier to collect material in this way than by aimless digging in the sawdust, although they do occur in the loose sawdust. When the weather becomes cold in the fall, it is usually necessary to dig until a region is reached which is warmed by fermentation of the sawdust. It is not known how many years a given sawdust pile will remain

suitable for *hubbardi*, but one at Priest Bridge, Md., which is the source of material collected by H. S. Barber in 1932, has yielded very few specimens during 1937. The wood has apparently decomposed too far to suit the insects.

Under very favorable conditions a slab of 3 or 4 square feet in area may have as many as 100 individuals upon it, or beneath it, when the sawdust covering is removed, although about 25 is more usual. Both apterous adults and nymphs of the apterous form are almost always present. Winged adults are unusual, but deälate adults are not rare. At Hunter, Va., Sept. 20, 1937, the writer found six deälate females and four winged females in about three hours of collecting, during which time apterous specimens were seen in abundance. This represents the writer's largest single catch of winged and deälate material; usually about three deälate specimens and, if one is fortunate, one winged specimen are taken in such a period. One deälate male was collected, the first male *hubbardi* of this form; all others were females.

There are two views regarding the presence of *hubbardi* in the Washington area; one is that the species is a comparatively recent introduction from more southern States and is able to live at this latitude only by taking advantage of the artificial conditions of sawdust piles. The other view is that they can maintain themselves under bark and in rotting logs, but very few northern colonies have been found in such locations, and whether the species is capable of maintaining itself about Washington by such means alone is not known.

An observation cell was made by taking a glass jar about 4 inches in height and 2 inches in diameter, lining it with thin flat strips of decaying wood, and loosely filling the interior with decaying sawdust. Specimens placed in two such cells, established July 31 and August 8, 1937, respectively, and kept at room temperatures, lived until mid-November, and a few specimens, or their progeny, were still alive January 9, 1938. A few drops of water were added at intervals of several days. The jars were tightly closed except for small holes, as a constant, high humidity appears to be essential. If the jar is kept in darkness, individuals will move actively about between the glass and the outer surface of the wood lining, but when exposed to light they gradually move to the darker side of the jar or through the lining to the inside of the cell.

There is little social behavior among these insects. Individuals often approach each other, cross their antennae for a moment, and then move hurriedly away. No care of young has been observed. Mating has twice been observed, but unfortunately the respective positions of the two sexes were not determined in either instance. On August 5 one apterous adult was seen to climb upon the dorsal surface of another facing in the same

direction. Then their genitalia were united and the one that had been above scrambled to the surface of the wood and slowly advanced, dragging its mate behind. The latter was on its back during this procedure, made only slight movements, and the pair remained in copula about one and one-half minutes, during which time about 1 inch of surface was traversed. Then they suddenly separated and each hurried away. The second mating was observed August 9. Two apterous individuals were end to end when first noticed, one advancing slowly and the other, with its legs in the air, being dragged over the wood on its back. This procedure was as seen in the first observation, and after about one minute the two separated.

The principal food of *Zorotypus hubbardi* can not be stated definitely. Individuals move about, frequently stopping to clean their antennae and tarsi and occasionally nibbling at particles of wood, but no regular feeding upon the wood has been noticed. One individual was seen to attack a small mite, but finally left it unharmed. Another was observed carrying the head capsule of one of its own species in its mandibles. In connection with experiments to secure eggs, to be discussed later, groups of six apterous females each were placed in separate vials. In several cases, after one or more individuals had died and the bodies had been allowed to remain, only the head capsule and fragments of legs and body were left after a few days had elapsed, indicating that *hubbardi* may act as a scavenger on dead arthropods. Upon dissecting one of the remaining females, in one such instance, apparent fragments of *hubbardi* were found in the alimentary canal. Specimens that have been treated with caustic potash, rendering them largely transparent when mounted on slides, show that fungous spores are almost invariably present in the food contents. H. E. Ewing has identified the following fragments of mites from the alimentary tract of specimens of *hubbardi:* From an apterous female, Magnolia, Livingston Parish, La., Feb. 23, 1934, leg fragments of a tyroglyphid mite of the genus *Rhizoglyphus;* from apterous male, Priest Bridge, Md., July 31, 1937, 7 legs of a tyroglyphid mite; apterous male, Priest Bridge, Md., Aug. 15, 1937, two legs of an oribatoid mite. These data, in conjunction with Silvestri's (1913) observations that remains of arthropods, especially Acarina, occur in the stomach contents of *Zorotypus*, suggest rather definitely that animal matter constitutes a normal food of Zoraptera.

In order to secure eggs, individual vials were used, each of which contained only a small piece of decayed wood. The vials were placed in a moist chamber in which a handful of decaying sawdust was placed to conserve moisture. Each vial was closed by a cloth stopper and numbered. Data were taken daily and water occasionally applied to the piece of wood with a pipette.

Deälate females were isolated but apterous females were handled in groups of six to each vial. From 18 apterous females collected at Priest Bridge, Md., Aug. 15, 1937, 4 eggs were secured Aug. 17, and 1 Aug. 22. All were laid upon the piece of wood except one which was attached lightly to the surface of the glass. One egg was broken when found. Of these eggs, two hatched Sept. 7, one Sept. 8, and the fourth Sept. 10.

A deälate female collected at Priest Bridge, August 15, deposited an egg Aug. 17. This hatched Sept. 7. No other eggs were secured, although isolations were made of 6 deälate females and 12 apterous females collected Sept. 20 and 4 deälate and 24 apterous females collected Oct. 3, at Hunter, Va. Of the group taken Sept. 20, three apterous specimens were active at this writing (Nov. 9) as well as two deälate and six apterous females from those collected Oct. 3. A large percentage of females taken during June, July, and August, contain single large eggs, but no large eggs have been found in females collected during October and early in November. This suggests that eggs are not laid during the fall.

None of the nymphs hatching from eggs was reared successfully. One nymph lived six days isolated in a small vial of woody debris.

In order to secure winged adults, nymphs with wing pads, compound eyes, and ocelli were isolated. Only one, a female, was reared successfully. The nymph was collected at Priest Bridge Aug. 15, and matured Aug. 22. Six additional nymphs were isolated and a darkening of the wing pads preparatory to the final moult was noticed in several, but none matured, though one lived until Sept. 8. The entire period of nymphal and adult life probably occupies several months, judging from several adults that have lived as long as 75 days. One teneral winged female, collected Sept. 12, shed its wings Sept. 17, but died Oct. 15, without ovipositing.

Zorotypus shannoni, new species.

(Pl. IV, figs. 44–48.)

Winged male.—Size medium to small for the genus; readily recognizable by the form of the tenth tergite, as well as by the features of the eleventh tergite, subgenital plate, and genitalia.

Antenna as in fig. 48; second and third segments much smaller than others; second curved at base, third straight. Wings lacking except usual bases of deälate form and basal third of left front wing, venation of the latter as in *hubbardi*.

Hind leg as in fig. 46; femur armed with one light to moderately heavy spine near basal third of posterior ventral margin; there is an indication of a second spine having been present immediately distad; six shorter spines along apical half; two strong setae basad of the basal spine and three weak setae apicad of it.

Subgenital plate as in fig. 47; sparsely covered with short setae of uniform length; apex emarginate, its lateral extremities prolonged into curved flaps which are flattened and not spine-like. The flaps and the portion of the plate proper distad of the dotted line shown in fig. 47 bear a sclerotized internal lining.

Tenth tergite in dorsal view as in fig. 45; roughly a broad triangle in outline, with its base extending ventro-anteriorly beneath the ninth tergite; apical margin more heavily sclerotized than remainder of sclerite; conspicuously armed with caudally extending spines; greatly strengthened ventro-anteriorly so that a definite central supporting rod is formed; appearing as in fig. 44 in caudal view, the posterior surface bearing numerous setae, regularly placed as illustrated.

Eleventh tergite broadly emarginate at apex (fig. 44); a median finger-like process somewhat broadened toward its apex, curves dorso-anteriorly in close contact with posterior surface of tenth tergite.

Genitalia composed of several conspicuous sclerites and several of less definite form embedded in chitinized membrane, appearing as in fig. 44 in caudal view after potash treatment; a chitinized spherical pouch is associated with the sclerites.

Coloration.—General color deep brown; basi-tarsus, apical third of second tarsal segment and claws pale; caudal spines and median supporting rod of tenth tergite black; apex of subgenital plate, distad of dotted line in fig. 47, a darker shade of brown than remainder of plate due to presence of internal lining.

Measurements.—Length of body 1.5 mm., of pronotum .3 mm., of hind femur .6 mm.

Type locality.—West Border of Matto Grosso, Brazil, South America.

Type.—No. 52272, U. S. National Museum.

A single alate male collected by R. C. Shannon, May, 1931. The specimen has been treated with caustic potash and the apical segments of the abdomen removed for study; all are now preserved in alcohol. The species most likely to be confused with *shannoni* is *manni* Caudell, described from Bolivia; the male of *manni* is unknown, but the two species may be distinguished by the differences in the armature of the hind femur.

The species is named in honor of its collector, Mr. Raymond C. Shannon.

Zorotypus snyderi Caudell.

(Pl. II, figs. 11–24.)

Zorotypus snyderi Caudell, Proc. Ent. Soc. Wash., Vol. 22, pp. 90–97, fig. 5, 1920.

The femoral spines distinguish the present species from *hubbardi*, although there is considerable variation in the spines as shown in figs. 17–21 and 23. The specialized structures of the male are the best features for the recognition of the species.

No previously unrecorded material from the United States is available, but a most interesting collection of 11 apterous

females, 7 apterous males, and 2 nymphs of the apterous form was made by E. A. Chapin and R. E. Blackwelder at Gordon Town, Jamaica, Feb. 4, 1937, "in rotting banana stems." Study of the male genitalia indicates that the Jamaican material is conspecific with that described from Florida as *snyderi*. The nymphs are subequal in size to the two original specimens of *longicercatus* Caudell, described from Jamaica, but the cerci show that two species are involved.

There are close affinities between the land faunas of Cuba and Florida, as a result of natural agents of dissemination, but the faunas of Jamaica and Florida are not so closely related. It is possible, therefore, that commercial transportation of plant materials, rather than natural causes, is responsible for the presence of *snyderi* in both Florida and Jamaica.

The apical sternite of *snyderi* (fig. 12) is emarginate at the apex and has a broad mesal depression. The apical tergite (fig. 22) is heavily sclerotized and bears a median process at a level somewhat ventrad of the lateral lobes.

The genitalia are of the same general type as in *cramptoni*, but very distinct from the latter in details. On the floor of the abdomen is a horseshoe-shaped basal plate (fig. 11) which is composed of two arms that are united anteriorly and are joined by a cross bar at their bases. The protrusile parts are hinged at the base of the basal plate, their relative positions being as in fig. 11 when seen in ventro-lateral view. When in a retracted condition the clasping organs are folded back and lie dorsad of the basal plate (fig. 24). The clasping organs are enclosed in a mass of membrane and muscle, and when studied in a caustic potash preparation (figs. 11, 14, 24) are seen to be composed of the following elements: A long filament, bearing spine-like projections which may be extended as illustrated or closely appressed to one another and rendered inconspicuous, which takes the form of a coiled spiral; paired dorsal lobes which are scoop-like at their apices; paired, lateral, hood-like lobes that partly conceal the median coiled filament when seen in lateral view. A slender filament is borne by each lateral lobe. As in *cramptoni*, the homologies of these parts are not fully understood at present.

The "apterous adults" of Caudell (1920, pp. 92–93) are certainly only ordinary apterous adults. A study of the original material, including the "apterous pigmented male" collected at Miami Beach, Fla., Feb. 28, 1919, shows that no forms or "castes" different from the two found in *hubbardi* occur. According to H. S. Barber, who has observed both species in life, apterous adults of *snyderi* appear somewhat more darkly pigmented than those of *hubbardi* and run more actively. This apparently led to Caudell's misunderstanding and to the confused statement by Snyder (1924, p. 3) that apterous reproductive forms are darkly colored and have ocelli in *snyderi* but are colorless and without ocelli in *hubbardi*.

Zorotypus cramptoni, new species.

(Pl. IV, figs. 49–54.)

Apterous male.—Size medium to large for the genus; distinctive in the armature of the apical tergites (fig. 54), the form of the genitalia (fig. 51), and the armature of the hind femur (fig. 50). The species most likely to be confused with the present one is *neotropicus* Silvestri, described from Costa Rica. According to the description of the latter, it differs from *cramptoni* in the proportions of the second and third antennal segments, in the armature of the hind femur, and in its considerably smaller size. The size, however, is subject to variation and may depend upon the manner in which specimens are preserved.

Only basal four segments of each antenna present, agreeing with fig. 53 of female antenna in other respects; second segment two-thirds the length of third. Hind femur as in fig. 50. Hind tibia without subapical spines, unlike *shannoni* (fig. 46).

Subgenital plate and eighth sternite as illustrated (fig. 49), thus differing in a striking manner from the Floridian and Jamaican *snyderi.* Apical tergites as in fig. 54, the ninth tergite broadly extending mesally at its base (this portion normally covered by apex of eighth tergite, its lateral extensions near bases of cerci not completely shown in figure); tenth tergite with seven strong, regularly spaced, curved spines on each side of disk; apparent eleventh tergite fused with tenth, with a dense group of slender setae borne on each side apically, and an apical process which curves dorsally in the form of a hook, much as in *caudelli* (fig. 27).

Genitalia of same general type as in *snyderi* (fig. 51). A basal plate (fig. 52) attached to the subgenital plate by a basal fork normally extending anteriorly in abdomen across eighth sternite and nearly to base of seventh sternite, its outline dimly seen through ventral body wall in specimens not treated with caustic potash. Extended portion of genitalia in lateral view as in fig. 51; composed of the following elements: A mesal tapering filament which takes the form of a spiral; a pouch-like structure at the base of the filament; a paired hood-like structure partially surrounding the spiral, less developed than a similar structure in *snyderi;* two paired dorsal lobes, corresponding to the dorsal scoop-like structures of *snyderi;* several non-sclerotized membranes surrounding the dorsal lobes, which are of rather indefinite form, indicated by the stippled areas in fig. 51.

Coloration.—General color pale brown; ventral region of thorax, and tibiae and tarsi, light amber.

Measurements.—Length of body 2.4 mm., of pronotum 0.51 mm., of hind femur 0.93 mm.

Apterous female.—General form as in apterous male. Antenna as illustrated (fig. 53). Hind femur like that of male. Caudal margin of seventh tergite bearing 14 setae, of which the third from the mesal line on each side is decidedly more conspicuous than the others. Caudal margin of eighth tergite with 16 setae, of which the second and third from the mesal line on each side are more strongly developed than the others. (This is essentially as in the apterous males, but the dorsal setae of the latter specimens are not well preserved.) Ninth and tenth tergites simple, subequal in length, each armed on each side of mesal line with a seta which is about one-half length of third lateral spine of eighth tergite.

Coloration.—Like that of male; apical two antennal segments pale.

Measurements.—Length of body 2.58 mm., of pronotum 0.48 mm., of hind femur 0.81 mm.

Nymph of winged form.—Apparently in stage immediately preceding maturity; general form as in *hubbardi,* robust.

Ocelli and compound eyes well developed. Antenna nine-segmented, the second segment noticeably shorter and smaller than the third. Armature of hind femur as in adult, but not so heavily developed. Wing pad of front wing extending nearly to apex of third abdominal tergite; of hind wing one-half the length of fourth tergite. Abdominal segments unspecialized; setae of same arrangement as in adult.

Coloration.—General color yellow-cream; eyes black; ocelli, spines, and setae brown.

Measurements.—Length of body 2.04 mm., of pronotum 0.42 mm., of hind femur 0.57 mm.

Type locality.—Mixco, Guatemala.

Type.—No. 52274, U. S. National Museum.

Holotype.—Apterous male collected by W. M. Mann in May, 1924.

Allotype.—Apterous female, with same data as holotype.

Paratypes.—One apterous male, one apterous female, and one nymph of winged form with same data as holotype.

The holotype and male paratype were originally mounted on a slide and the appendages have largely become detached from the body during the removal which was necessary for a study of the genitalia. The appendages are now mounted on two separate slides; the bodies, as those of the remaining specimens, are preserved in separate micro-vials. The females and nymph are in excellent condition.

The writer is particularly glad to name this species in honor of his friend and former teacher, Dr. G. C. Crampton, of the Massachusetts State College, whose work has been intimately associated with the morphology and phylogeny of primitive insects for nearly a third of a century.

Zorotypus barberi, new species.

(Pl. III, figs. 32–39.)

Apterous male.—General form robust, medium to large for the genus. A very striking species not to be confused with any other on account of the heavily developed spines on hind femur (fig. 34) as well as distinctive male features.

Antenna as in fig. 33; second segment somewhat shorter than third; apical six segments subequal in length. Hind coxa bearing a prominent apical spine at latero-posterior angle; a pair of strong curved apical spines borne laterally just anterior to the articulation of the trochanter. Hind leg as in fig. 34.

Apex of abdomen as in fig. 35 in dorsal aspect. Apical tergite weakly sclerotized mesally at its base, appearing as triangularly emarginate; a dorsally curved process borne apically. Ninth tergite with small apical process; two

paired mesal processes, each apparently resulting from the fusion of strong setae arranged in a row. In lateral view (fig. 32) these paired processes are much thinner than in frontal aspect.

Ventral view of apex of abdomen as in fig. 36. Ventral plate of genitalia and supporting rods visible along floor of abdomen; attachments on subgenital plate. Genitalia (figs. 37–39) composed of the following elements: A weakly sclerotized ventral plate attached to subgenital plate; moderately sclerotized, paired dorsal lobes or pouches, the mesal pair bearing membranous flaps at their apices; a hood-like posterior portion which bears heavily sclerotized pointed processes anteriorly; a sclerotized spine-like organ within the central mass of the genitalia and extending within "hood"; paired sclerites, each of which is folded, lying laterally just dorsad of the ventral plate; a mesal plate, broadly emarginate apically, borne on the ventral plate; a mesal lobe, located anteriorly which bears a heavily sclerotized, tapering rod; paired rods extending anteriorly from the central mass of the genitalia; an unsclerotized membrane uniting the basal rods.

Coloration.—General color light amber; thoracic notum light brown; spines of posterior ventral margin of hind femur dark brown.

Measurements.—Length of body 2.22 mm., of pronotum 0.42 mm., of hind femur 0.66 mm.

Type locality.—Cocos Island, west coast of Central America.
Type.—No. 52273, U. S. National Museum.

A single apterous male collected by W. Schmidt, Mar. 1, 1933, "under . . . debris back of beach." The specimen has been treated with caustic potash, figs. 35 and 36 having been made before the treatment. The genitalia were then removed without detaching any of the abdominal segments from the remainder of the body; the body and genitalia are preserved in separate micro-vials.

This remarkable insect is named in honor of the writer's friend and colleague, Mr. Herbert S. Barber.

Zorotypus longicercatus Caudell.

(Pl. II, fig. 26.)

Zorotypus longicercatus Caudell, Proc. Ent. Soc. Wash., Vol. 29, No. 6, pp. 144–145, 2 figs., 1927.

No information is available regarding this species in addition to that given in the original description, which was based upon two wingless nymphs. This is the second of the two species found in Jamaica, *snyderi* having been recorded in this paper for the first time.

Zorotypus manni Caudell.

(Pl. III, figs. 40–41.)

Zoraptera (error for *Zorotypus*) *manni* Caudell, Proc. Ent. Soc. Wash., Vol. 25, No. 3, pp. 60–62, 1923.

The holotype, a deälate female, is the only known specimen. Judging from the armature of the hind femur, *manni* is distinct from *shannoni*, here described, although known from Bolivia not far from the Matto Grosso Region of Brazil.

Zorotypus neotropicus Silvestri.

Zorotypus neotropicus Silvestri, Boll. Lab. Zool., Portici, Vol. 10, p. 120, 1916.

This species was described from adult and immature specimens collected at San José, Costa Rica. The hind margin of the posterior femur is said to bear eight short, scarcely robust setae. A single, broken, deälate female in the National Museum with the following data may possibly represent *neotropicus:* Farm Hamburg, Costa Rica, Sept. 9, 1926, under loose bark, Ferd. Nevermann.

Zorotypus swezeyi Caudell.

(Pl. III, figs. 42–43.)

Zorotypus swezeyi Caudell, Trans. Amer. Ent. Soc., Vol. 48, pp. 133–135, 1922.

Waipio Ridge, Oahua, Hawaii, alt. 1,500 feet, Aug. 11, 1929, in decayed log of *Acacia koa* in forest, O. H. Swezey, two apterous adult females (U. S. National Museum Collection).

The above material is previously unrecorded. Fullaway (1924) reported and exhibited a winged specimen collected in a rotten log at Kokee, Kauai. The species was originally described from five apterous females collected at Kokee.

Zorotypus philippinensis, new species.

(Pl. IV, figs. 55–56.)

Deälate female.—Size small for the genus. Antenna as in fig. 56; basal segment nearly twice the length of second segment; second segment decidedly shorter than third. Hind leg as in fig. 55; ventral margin of femur weakly armed toward base; subapical ventral spine of hind tibia distinct but small, no conspicuous spines along margins of tibia; two strong setae on ventral margin of basitarsus as well as several minute setae.

Subgenital plate broadly rounded, unspecialized at apex; setae sparse and slender. Apical tergites of usual female type, unspecialized. Cercus roughly oval in dorsal aspect; a terminal seta nearly twice length of cercus; one lateral seta on each side of terminal one, arising near its base and extending diagonally from it on each side, slightly longer than cercus; cercus without trace of annulation.

Coloration.—General color medium brown; tarsi and apical two segments of antenna pale.

Measurements.—Length of body 1.98 mm., of pronotum 0.36 mm., of hind femur 0.6 mm.

Type locality.—Saravia, Occidental Negros, Philippine Islands.

Type.—No. 52275, U. S. National Museum.

A single deälate female collected "in forest," April 12, 1929, by W. D. Pierce.

The present species may be readily distinguished from *swezeyi* and *caudelli* by differences in femoral armature. The basal antennal segment of *silvestrii* is subequal in length to the second segment, thus differing from *philippinensis*. The cerci in *javanicus* and *buxtoni* are prolonged in a spine-like process and show a trace of annulation, while the cercus of *ceylonicus* is more broadly rounded apically than in the present species and lacks distinct lateral setae extending from near the base of the terminal seta.

Zorotypus javanicus Silvestri.

(Pl. II, fig. 29.)

Zorotypus javanicus Silvestri, Boll. Lab. Zool., Portici, Vol. 7, pp. 208–209, figs. 12, 13, 1913.

Zorotypus javanicus Silvestri, Karny, Treubia, Vol. 9, pp. 1–5, figs 1–3, pl. 1, 1926.

This species was originally described from an immature female taken at Samarang, Java. Karny has since reported apterous adults of *javanicus* from Tjibodas, Java.

Zorotypus buxtoni Karny.

Zorotypus buxtoni Karny, Insects of Samoa, Pt. 7, fasc. 4, pp. 117–119, fig. 1, 1932.

Described from a single broken specimen taken in rotten wood on the island of Upolu, Samoa. Karny was not sure whether the specimen was adult or immature, and no mention was made of the hind legs. The cercus is elongate, conical, and terminates in a thick seta at the base of which is an annulation as in *javanicus*.

Zorotypus silvestrii Karny.

(Pl. II, fig. 25.)

Zorotypus silvestrii Karny, Treubia, Vol. 9, pp. 1–5, figs. 1–3, pl. 1, 1926.

The original material included three apterous adults and four immature specimens collected at Sabirut, Mentawei Island, East Indies, under the decayed bark of a dead log.

Zorotypus caudelli Karny.

(Pl. II, figs. 27–28.)

Zorotypus sp., Karny, Treubia, Vol. 3, pp. 14–29, figs. 1–7, 1922.

Zorotypus caudelli Karny, Treubia, Vol. 9, pp. 1–5, fig. 1, pl. 1, 1926.

Winged, wingless, and immature material of *caudelli* is known. The species is distinctive both with respect to the spines on the hind femur and the specialization of the apical abdominal tergites of the male. The species was described from the Lampong District of Sumatra.

Zorotypus guineensis Silvestri.

(Pl. II, fig. 30.)

Zorotypus guineensis Silvestri, Boll. Lab. Zool., Portici, Vol, 7, pp. 205–206, figs. 1–7, 1913.

The cercus of this species, the genotype, is similar to that of *javanicus* and armed with a robust terminal seta. *Z. guineensis* Silvestri was collected at Aburi, Gold Coast, West Africa.

Zorotypus ceylonicus Silvestri.

(Pl. II, fig. 31.)

Zorotypus ceylonicus Silvestri, Boll. Lab. Zool., Portici, Vol. 7, pp. 207–208, figs. 8–11, 1913.

The species was taken at Pundaluvya, Ceylon.

OTHER SPECIES OF ZORAPTERA.

In 1927 a mass of debris from Cuba containing insect remains was intercepted in quarantine and a single front wing of a zorapteron was included. No other record from Cuba is known.

Denis (1933) reported the collection of a single immature specimen of Zoraptera in January, 1931, at Dalat, Indo-China. It had eight antennal segments. No name was given.

Beebe (1925, p. 72) has reported the finding of a single wingless zorapteron in a termite nest at Kartabo, British Guiana. It is referred to again by Costa Lima (1937), who says also that material of *Zorotypus* has been collected near Rio de Janeiro, Brazil, which is said by Silvestri to represent a new species. The latter species was taken in association with passalid larvae in decaying wood of brocado.

Regarding the Genus *Menonia* George.

Menonia cochinensis was described by George (1936) as a new genus and species of Zoraptera. The material consisted of a single specimen collected from dry foliage on the ground at Tripunithura, Cochin State, South India. The following are among the important characters either described or figured:

Apterous. Maxillary palpus five-segmented. Labial palpus three-segmented. Tarsi three-segmented, the basal segment much longer and heavier than the second. Cercus long and tapering toward apex, four-segmented, the basal three

segments bearing macrotrichia and sensory hairs, the apical segment annulated. Eyes small. Ocelli absent. Antenna not moniliform (lost beyond the sixth segment); segments short and cylindrical. Hind femur broad and well developed. Length of body (excluding cerci) 1.27 mm., length of cerci 0.6 mm.

From a study of the characters and the general form of the insect, which is illustrated in entirety by its author, it appears very doubtful if the species is properly referable to the Zoraptera. It is very suggestive of Gryllidae in many respects, and many small species of Trigonidiinae are known from India. A nymph of the size given above would be difficult to study in all its details and might easily be confused with another group of insects. From the data available the writer can not be sure of the proper placement of *Menonia*, but it is tentatively transferred to the Gryllidae.

THE PHYLOGENETIC RELATIONSHIPS OF THE ZORAPTERA.

When the order Zoraptera was established, Silvestri (1913) mentioned affinities with Blattidae and Isoptera. The first known collector of these insects, H. G. Hubbard, noticed the superficial resemblance to Corrodentia (see Caudell, 1918), and in recent years the tendency has been to group them near this order or to treat them as a suborder of Corrodentia. In almost any group of insects different features of structure are suggestive of relationship to various other groups and it is difficult to state definitely which order is most nearly allied to Zoraptera or from which group they are most likely to have been derived. Until more conclusive evidence is available, therefore, it seems best to mention the relationships suggested by the different features of these insects and attempt to summarize opinions previously proposed.

The head capsule is of a generalized type which Crampton (1932, p. 31) has likened to that of primitive Corrodentia and several orthopteroid groups. Snodgrass (1937, p. 18) has pointed out that the prominently developed postclypeus of psocids is absent in *Zorotypus*, and suggests that the head capsule of *Zorotypus* shows closer affinity to orthopteroid forms. It should be noted, however, that there is a considerable range in the size of the postclypeus throughout the Corrodentia. Because of this fact the head capsule of *Zorotypus* is very suggestive of that of *Embidopsocus* and *Embidotroctes*, but considerably unlike that of *Psocus*, and the affinities with the Corrodentia based upon a consideration of the head capsule may be considered as close as those with the Orthoptera, if not more so. The maxillae (see Silvestri, 1913, fig. 4) are typical of Orthoptera. In psocids there is a conspicuous "maxillary fork," "pick" or "chisel" which differs from the usual lacinia

of orthopteroid insects in being much more elongate and not closely attached to the main body of the maxilla. A similar structure is present in some Mallophaga. Crampton (1929, p. 473) and others have noticed this similarity, but the actual homologies have been the subject of some controversy and only recently has Badonnel (1934, p. 73–82) demonstrated, by a study of nerve and muscle connections, that the "fork" of psocids is a true lacinia which is not actually detached from the stipes, only greatly modified. He has found that the muscles are comparable to those of an orthopteroid maxilla. Such a specialized type of lacinia as occurs in Corrodentia is not present in *Zorotypus*. Crampton (1923, p. 91) says zorapteran maxillae are more like those of Orthoptera than of Isoptera.

Regarding the thoracic sclerites, these are suggestive of relationship with Plecoptera and other lower orders, as well as with Corrodentia, and no one order is more strikingly like Zoraptera than are certain others. The wings resemble those of termites in that they break off near their bases, leaving definite stubs. The line of breakage is not so clear cut as in most termites, but from the evidence of specimens examined the break normally occurs at about the same place. Karny (1922) was impressed by the similarity in structure of the wings of *Zorotypus* to those of roaches of the subfamily Corydiinae, particularly the genera *Cardax* Shelford (now replaced by *Caradax* Shelford), *Alluaudella* Shelford (now replaced by *Alluaudellina* Chopard), and *Cardacopsis* Karny. These genera have been illustrated by Shelford (1908, pl. 9, figs. 3–7; 1910, figs. 1–4) and Karny (1924, fig. 10) and the resemblance of the wings to those of *Zorotypus*, while more so than in those of most roaches, is not nearly so great as in the case of Corrodentia of the genus *Archipsocus*. Later, the same author (Karny, 1932) treated the *Zoraptera* as a suborder of Psocoptera (Corrodentia). Neotropical specimens of *Archipsocus* have wings very like those of *Zorotypus* in texture, venation and covering of setae. Crampton (1921 and in other papers) has emphasized this similarity; certainly the wings of Zoraptera are much more like those of certain Corrodentia than they are like those of Orthoptera and Isoptera.

Regarding the evolution of wing venation in the Corrodentia, Tillyard (1926b, p. 346) and Banks (1929) indicate that the type found in *Archipsocus* and its allies is a reduced rather than a primitive one. Tillyard (1935, p. 273), in treating of fossil psocids from the Upper Permian of New South Wales, established the genus *Zoropsocus* to receive a species from which he thought the Zoraptera might have been derived by still further reduction of the venation. The venation of *Zoropsocus* is not as suggestive of *Zorotypus* as that of *Archipsocus*, but the shape of the wing is more like that of *Zorotypus*. In this connection it should be noted that while the wing of *Archipsocus* is much

wider at the base than that of *Zorotypus*, the wings of *Embidopsocus* and *Embidotroctes* approach the shape of *Zorotypus*. Carpenter (1933) has discussed fossil psocids from the Lower Permian of Kansas, and, judging from his conclusions, the front and hind wings of the earliest Corrodentia were of very similar shape, size and venation, unlike the dissimilar front and hind wings of *Zorotypus* and most recent psocids. Handlirsch (1930) has pointed out that the wings of Zoraptera are much more specialized than the mouthparts or abdomen, and the study of both fossil and recent Corrodentia supports that view, since the wings would seem to place the Zoraptera high up in the development of the latter group, although many other body structures are suggestive of an orthopteroid relationship.

The two-segmented tarsus of *Zorotypus* is comparable to that of many psocids, but the number of tarsal segments is known to vary so much within given groups of insects that this feature is of limited value for interpreting relationships.

The terminal abdominal segments of *Zorotypus* differ from those of Corrodentia in the presence of cerci and are much like those of certain termites, as has been pointed out by Crampton (1929, p. 472) who concludes that the Zoraptera are the most primitive of the psocids and indicate a descent from protorthopteroid ancestors resembling ancestral termites in many respects. Tillyard (1926b, p. 326) reported what he believed to be cerci in the fossil remains of a Permian psocid from Kansas, but Carpenter (1932), who examined the specimen studied by Tillyard, has doubted that it was really a psocid but rather the head end of another insect. Later Carpenter (1933, p. 447), was unable to find traces of cerci or genital appendages in a considerable series of Permian psocids. In most recent psocids a tubercle is borne by each paraproct which Chapman (1930, p. 222) has called the *sense tubercle of paraprocts*. It is barely possible that this tubercle has some relation to the cercus of orthopteroid insects, and, if so, the differences between the apical segments of *Zorotypus* and Corrodentia are less important than might otherwise be supposed. Crampton (1920, p. 102) reported that the eleventh tergite and the parapodial plates (paraprocts, lateral parts of the eleventh segment) are apparently fused with the tenth tergite. From a study of five species, of which males are available for study, it is now possible to state that the parapodial plates seem to be weakly sclerotized and easily overlooked, but that the eleventh tergite proper is usually fused to the tenth tergite. In the remarkable *shannoni* (fig. 44) what is apparently the eleventh tergite is distinct from the tenth and bears a process at the base of an apical emargination. In *cramptoni* a weakly sclerotized arc apparently demarks the junction of the two apical tergites. As noticeable a line of fusion has not been noted in the other species, but it probably

occurs in *caudelli* (fig. 27). This interpretation is reasonable and is indicative of relationship with both orthopteroid insects and psocids with respect to the terminal segments.

The male genitalia of *Zorotypus* can not be properly homologized with those of other insects until some details of musculature and other indicators of relationship have been studied. The basal plates of *snyderi* and *cramptoni* are superficially suggestive of structures occurring in Anoplura (see Ewing, 1932) and in Corrodentia (see Chapman, 1930, figs. 1–8, etc.). The assymmetrical sclerites of *hubbardi* and *shannoni* may be comparable to the phallomeres of Blattidae, but such a conclusion can not be established at present.

The male reproductive system is of a primitive type and does not correspond closely to that of any other insects known to the writer. Snodgrass (1937, p. 19) has noted a resemblance of the spermatoza to those of the mantid, *Tenodera*, and since mantids are closely related to roaches and termites, in the opinion of most morphologists, this similarity is in keeping with other orthopteroid tendencies of *Zorotypus*. The female reproductive system is very simple. The digestive system is of a very generalized type and lacks the gastric caeca which are characteristic of most Orthoptera. The Malpighian tubules are six in number; Snodgrass (1935, p. 379) says that six have been reported in embryos of *Blatta*, *Xiphidium* (now referred to *Conocephalus*) and *Melanoplus*, but the same number occurs in some other insects also.

Turning to the bionomics of Zoraptera, the development of two types of reproductive individuals is indicative of a caste system and is unquestionably termite-like. Though *Zorotypus* lives in colonies, there is little contact between individuals, so that Wheeler (1923, p. 346) states "It is very doubtful whether the peculiar insects belonging to the order Zoraptera are social or even subsocial . . . It seems more probable that *Zorotypus* is merely gregarious like many psocids."

In conclusion, *Zorotypus* is largely orthopteroid with respect to the maxillae, the shedding of the wings and in displaying rudiments of a caste system. The wings are very strongly suggestive of Corrodentia. Other features, such as the head capsule, thorax and terminal segments of the abdomen, are both orthopteroid and psocid-like. It is fairly clear that the order Zoraptera is related to both of these main groups, probably more closely so to the psocids; an opinion regarding these affinities depends upon the relative importance which one wishes to attach to different structures. If the Zoraptera are nearest the psocids, it is of course natural that many orthopteroid features should be carried over in the evolution, since the psocids and their allies were probably derived from an ancient orthopteroid stock.

SUMMARY.

The order Zoraptera was founded by Silvestri in 1913 and three species were then described. Nine other species have since been described by Caudell, Karny and Silvestri, and the present paper includes 4 previously unknown species, making a total of 16. These are from the Nearctic, Neotropical, Ethiopian, Oriental and Australian Regions. Only one genus is known.

Two types of reproductive individuals, winged and wingless forms, suggest the elements of a caste system in the Zoraptera, but the habits are not those of true social insects. In this paper the results of preliminary life history work are reported, including the description of the egg and egg burster, the first stage nymph, and the transformation from the nymphal to the winged adult form.

The male and female reproductive systems and the alimentary canal of *Zorotypus hubbardi* Caudell are described. The male genitalia of five species are described; these are very valuable for identification purposes.

The principal features bearing on phylogenetic relationships are reviewed; the affinities with Corrodentia are more noticeable than those with orthopteroid insects.

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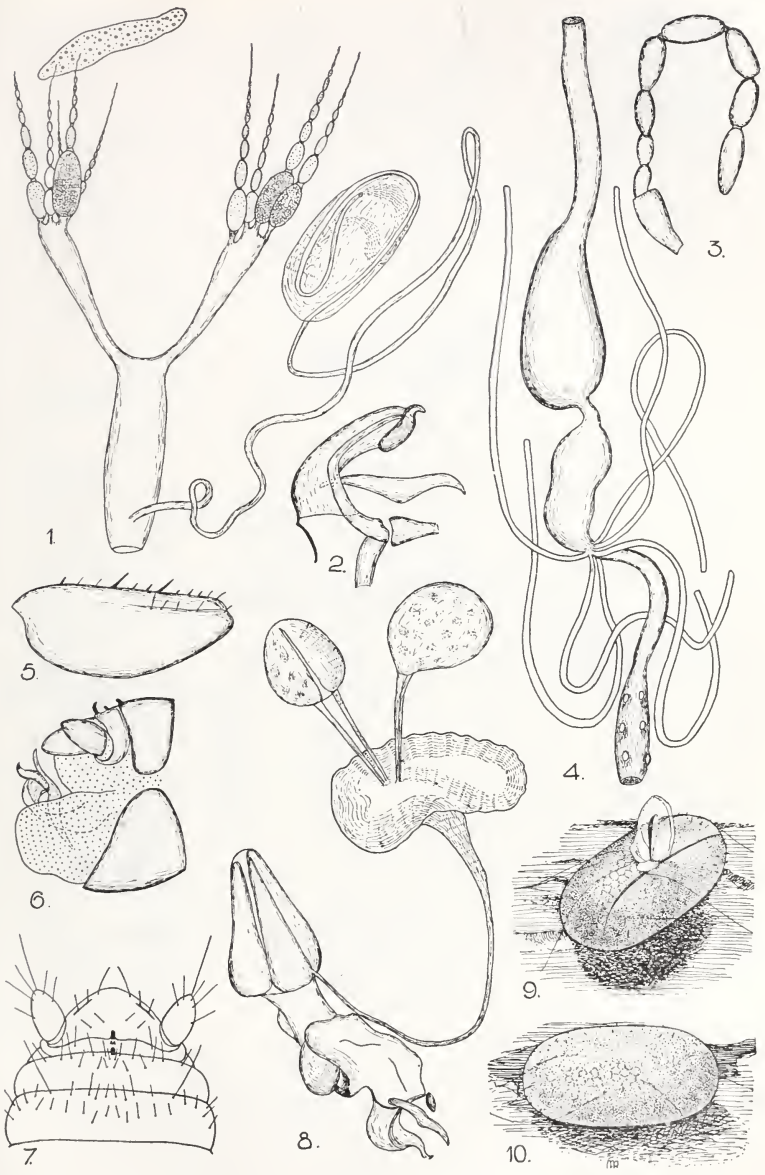
Explanation of Plates.

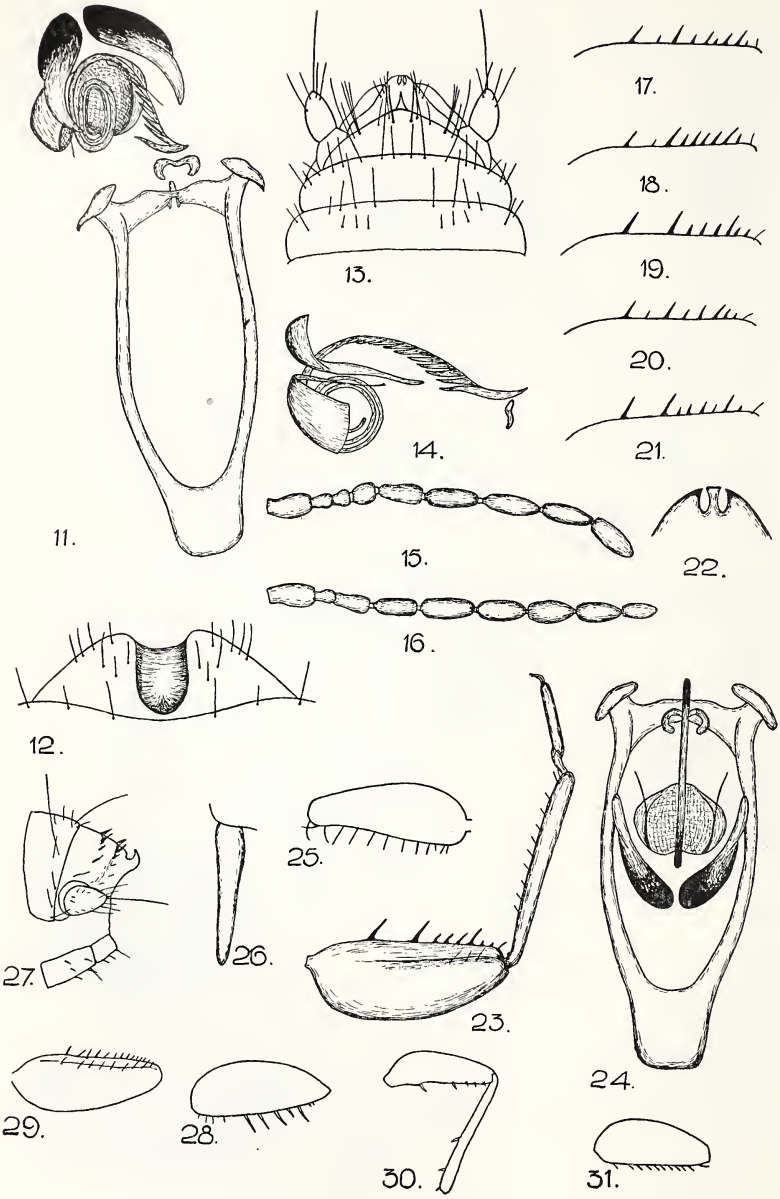
Plate I.

Fig. 1. *Zorotypus hubbardi* Caudell, female reproductive system, Priest Bridge, Md., Oct. 28, 1937.
Fig. 2. Same, dorso-lateral view of exserted male genitalia, KOH preparation, Priest Bridge, Aug. 15, 1937.
Fig. 3. Same, right antenna of male, Falls Church, Va., April 24, 1927.
Fig. 4. Same, alimentary canal, Priest Bridge, Oct. 28, 1937.
Fig. 5. Same, exterior surface of right hind femur, male, Priest Bridge, Oct. 17, 1937.
Fig. 6. Same, lateral view of apex of male abdomen, genitalia exserted, Priest Bridge, July 31, 1937.
Fig. 7. Same, dorsal view of apex of male abdomen, Falls Church, Va., April 24, 1927.
Fig. 8. Same, male reproductive system, Priest Bridge, Oct. 28, 1937.
Fig. 9. Same, egg of apterous female, showing appearance after hatching.
Fig. 10. Same, egg of apterous female, before hatching. (The fine threads in figs. 9 and 10 are fungous mycelium.)

Plate II.

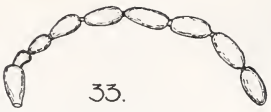
Fig. 11. *Zorotypus snyderi* Caudell, male genitalia in ventro-lateral view, clasping organs extended, Jamaica.
Fig. 12. Same, apex of male abdomen, ventral view, Jamaica.
Fig. 13. Same, apex of male abdomen, dorsal view, Jamaica.
Fig. 14. Same, extended part of male genitalia, lateral view, Jamaica.
Fig. 15. Same, left antenna of male, Jamaica. (Abnormal.)
Fig. 16. Same, right antenna of same specimen as in fig. 15. (Normal.)
Fig. 17. Same, ventral outline of right hind femur, male, Miami Beach, Fla.
Fig. 18. Same, left hind femur, female, Jamaica.
Fig. 19. Same, left hind femur, female, Miami Beach.
Fig. 20. Same, left hind femur, male, Miami Beach.
Fig. 21. Same, right hind femur from same specimen as in fig. 19.
Fig. 22. Same, dorsal view of apical abdominal tergite, male, Jamaica.
Fig. 23. Same, right hind leg, male, Jamaica.
Fig. 24. Same, male genitalia, retracted position, dorsal view, Jamaica.
Fig. 25. *Zorotypus silvestrii* Karny, hind femur (redrawn from Karny, 1926, fig. 2).
Fig. 26. *Zorotypus longicercatus* Caudell, ventral view of right cercus, holotype.
Fig. 27. *Zorotypus caudelli* Karny, lateral view of apex of male abdomen (redrawn from Karny, 1922, fig. 6).
Fig. 28. Same, hind femur (redrawn from Karny, 1922, fig. 5).
Fig. 29. *Zorotypus javanicus* Silvestri, hind femur (redrawn from Karny, 1926, fig. 2).
Fig. 30. *Zorotypus guineensis* Silvestri, hind femur (redrawn from Silvestri, 1913, fig. 5).
Fig. 31. *Zorotypus ceylonicus* Silvestri, hind femur (redrawn from Silvestri, 1913, fig. 10).


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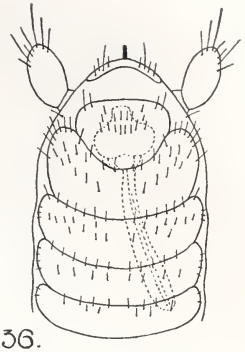

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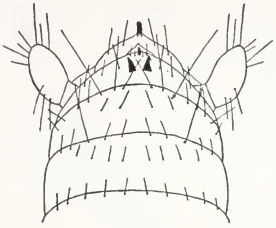
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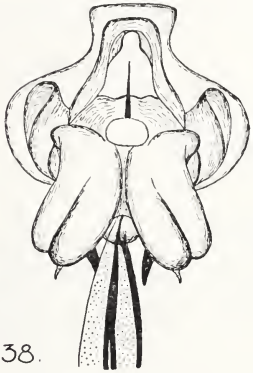
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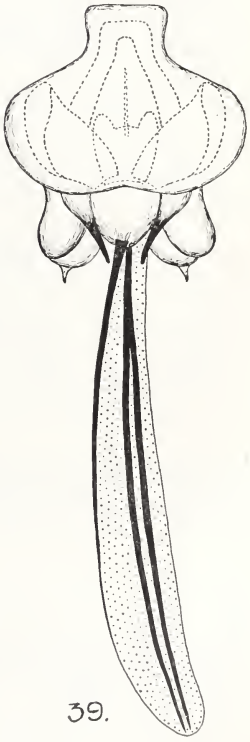
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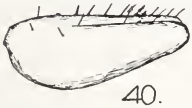
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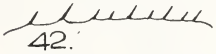
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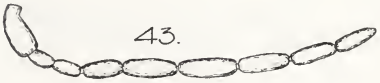
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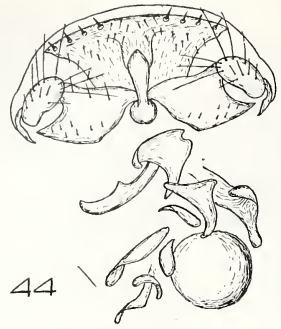
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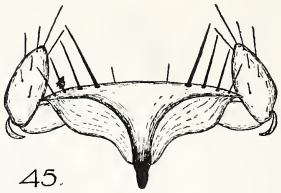


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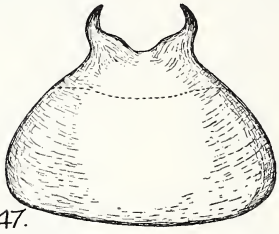


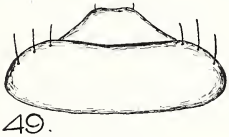
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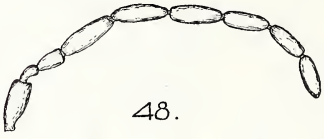

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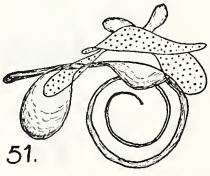

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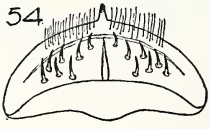

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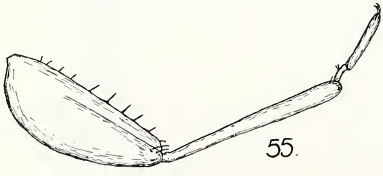

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Plate III.

Fig. 32. *Zorotypus barberi*, new species, lateral view of dorsal outline of apex of abdomen.
Fig. 33. Same, left antenna.
Fig. 34. Same, right hind leg.
Fig. 35. Same, apex of abdomen, dorsal view.
Fig. 36. Same, apex of abdomen, ventral view.
Fig. 37. Same, male genitalia, dorso-lateral view.
Fig. 38. Same, male genitalia, dorsal view.
Fig. 39. Same, male genitalia, ventral view.
Fig. 40. *Zorotypus manni* Caudell, right hind femur, holotype.
Fig. 41. Same, base of right antenna, holotype.
Fig. 42. *Zorotypus swezeyi* Caudell, ventral margin of left hind femur, holotype.
Fig. 43. Same, right antenna, holotype.

Plate IV.

Fig. 44. *Zorotypus shannoni*, new species, caudal view of apex of abdomen, with subgenital plate removed and genitalia treated with KOH.
Fig. 45. Same, apex of abdomen, dorsal view.
Fig. 46. Same, right hind leg.
Fig. 47. Same, ventral view of subgenital plate.
Fig. 48, Same, left antenna.
Fig. 49. *Zorotypus cramptoni*, new species, ventral view of apex of abdomen, male paratype.
Fig. 50. Same, right hind femur, holotype.
Fig. 51. Same, lateral view of exserted portion of genitalia, male paratype.
Fig. 52. Same, basal plate of genitalia, male paratype.
Fig. 53. Same, right antenna, allotype.
Fig. 54. Same, dorsal view of apical tergites of abdomen, male paratype.
Fig. 55. *Zorotypus philippinensis*, new species, right hind leg.
Fig. 56. Same, right antenna.

(Figs. 9 and 10 drawn by Mary Foley Benson, others by the author.)

A NEW SPECIES OF CISTALIA (HEMIPTERA–HETEROPTERA: LYGAEIDAE).

By H. G. Barber,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

In the collection of the United States National Museum there are two specimens from Cayamas, Cuba, collected by E. A. Schwarz, of what is undoubtedly *Cistalia signoreti* Guérin. So far as known this species does not occur elsewhere. Stål, who apparently did not have Cuban specimens for comparison, erroneously concluded that the specimens from Texas in the Stockholm Museum were *C. signoreti*. Uhler, two years later,

influenced no doubt by Stål's remarks, fell into the same error in recording Guérin's species from Texas as well as from Nevada and California. Although I have not seen any specimens from the last two States mentioned by Uhler, numerous examples, especially from Texas, in the collection of the National Museum are quite distinct specifically from the Cuban specimens, and the species is herewith described as new.

Cistalia explanata, new species.

Cistalia signoreti Stål, Enum. Hemip. IV, 1874, 165 (not Guérin) Uhler, Bull. U. S. Geol. and Geogr. Surv. I, 1876, 311 (not Guérin).

Closely related to *C. signoreti* Guérin described from Cuba and agreeing with that species in its general coloration. However, the antenniferous tubercles are larger and the antennae more incrassate than in Guérin's species. The basal segment of the antenna is gradually enlarged from the base toward the apex and all of the segments are densely pilose, without longer, scattered hairs. The pronotum has the lateral margin distinctly expanded. The costal margin of the corium is laminately expanded. The clavus is coarsely and irregularly punctate. The anterior femur has two or three preapical spinules below. Length 5–6 mm.

Type.—male, U. S. National Museum Cat. No. 52692, Victoria, Tex., Nov. 4, 1908 (W. D. Hunter). Paratypes males, 2 Victoria, Tex., Jan. 24, 1909, 3 Feb. 4, 1910, and 3 Feb. 22, 1916, hibernating in grass roots (J. D. Mitchell); Victoria, Tex., Feb. 1902 (E. A. Schwarz); Garcitas Creek, Victoria County, Tex., Dec. 16, 1911, under driftwood; Columbia, Tex., Dec., 1912; Willis, Tex., 1903; Brownsville, Tex., March 12, 1936, from soil roots of cotton (P. A. Glick). Females, 2 Victoria, Tex., Nov. 15, 1912, under log, Sept. 10, 1915, at light, and 3 Feb. 22, 1916, hibernating in grass roots (J. D. Mitchell); 2 Nov. 4, 1908 (W. D. Hunter); 3 Sept. (no other data); San Antonio, Tex., Dec. 22, 1879; Willis, Tex., 1909; Waco, Tex., and Austin, Tex., Oct. 12, 1901 (Uhler Collection); Columbia, Tex., Dec. 1872, and 1 Dec. 17, 1878, under bark at foot of live oak in cotton field (E. A. Schwarz); 2 Brownsville, Tex., March 13 and 16, 1936, in soil roots of cotton (P. A. Glick); 2 Texas (Belfrage); La. (Uhler Collection); Kans. Sept., 1872.

Although *Cistalia signoreti* and *C. explanata* are closely related, the former species can be most readily distinguished from the latter by the more slender antenna with the basal segment slightly constricted toward base and the lateral margin of the pronotum only carinate, not expanded.

TWO REARED NORTH AMERICAN SPECIES OF THE GENUS STANTONIA ASHMEAD (HYMENOPTERA : BRACONIDAE).

By C. F. Muesebeck,
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The genus *Statonia* was proposed by Ashmead, 1904,[1] for a Philippine species. Since then 13 species have been described, 8 of these being from the Oriental zoogeographical region, 3 from South America, and 2 from Africa. Prior to 1935 the genus was not known in the New World from north of Colombia. In that year, however, Bruner[2] reported the occurrence in Cuba of the first species described in the present paper. Recently a single specimen of another species, reared from the codling moth in Kentucky, was received for identification, this being the only specimen of *Stantonia* I have seen from the United States. Host associations in the genus are known only for the two species described below.

Stantonia lamprosemae, new species.

Figure 1.

Stantonia, n. sp., Bruner, Cuba Estac. Expt. Agron. Bol. 56 : 36, 1935.

This species is rather readily recognized by the black dorsal stripe on the posterior femur and the yellowish ventral stripe on the otherwise blackish posterior tibia.

Female.—Length 3.8 mm. Head strongly transverse, broader than thorax; temple narrow, receding, not more than half width of eye; face much broader than long, with scattered shallow punctation; clypeus broadly truncate, longer than malar space; maxillary palpus at least as long as width of head; distances between ocelli not greater than diameter of one of them; ocellocular line more than twice diameter of an ocellus; antenna 39-segmented, slightly longer than the body, some of the preapical segments barely longer than broad.

Thorax considerably higher than wide; notauli complete, finely foveolate; mesonotal lobes with scattered and very weak punctures; scutellum smooth and shiny; propodeum evenly convex, polished; pleura polished; mesopleurum with a long shallow foveolate groove; radial cell on wing margin considerably longer than stigma; the first radial abscissa oblique, about two-thirds as long as first intercubitus, the second straight, attaining wing margin well before apex; the triangular second cubital cell subsessile; second intercubitus very weakly developed; second abscissa of cubitus about equal to third; cubitus obliterated beyond second cubital cell; nervulus interstitial or slightly antefurcal; mediellan cell more than three times as long as submediellan; posterior coxa smooth and polished; inner calcarium of posterior tibia not more than half as long as metatarsus; posterior femur and tibia slender.

[1] Proc. U. S. Nat. Mus., 28 : 147, 1904.
[2] Cuba Estac. Expt. Agron. Bol. 56 : 36, 1935.

Abdomen smooth and shiny, longer and narrower than thorax; compressed apically; first tergite at least three times as long as broad at apex, only slighter broader at apex than at extreme base; second tergite longer than broad; third and following transverse, successively shorter; ovipositor sheath very nearly as long as the abdomen.

Honey yellow; antennae brown, somewhat paler beneath; first abdominal tergite black, brownish apically; following tergites with some irregular blackish markings medially; wings hyaline, stigma and veins dark brown; most of dorsal edge of middle femur, dorsal edge of middle tibia, and middle tarsus entirely, blackish; posterior leg with a small spot on outside of coxa at apex, second segment of trochanter, dorsal edge of femur except at base, tibia except for narrow stripe on the ventral edge, and tarsus, black.

Male.—Agrees with female in all essential respects.

Type locality.—Santiago de las Vegas, Cuba.
Type.—U. S. National Museum No. 52639.
Host.—*Lamprosema indicata* (F.).

Described from five females and two males: the type and the two males reared at the type locality by A. Otero, March 30 and 31, 1934; three females from El Cano, Cuba, reared in November, 1931, and a single female collected by H. L. Dozier at Mayagüez, P. R., October 18, 1935. All except the last-mentioned specimen were communicated by Dr. S. C. Bruner. The number of antennal segments in the paratypes ranges from 37 to 40, and there is more or less variation in the color of the abdomen, the first tergite being sometimes entirely black, while in other specimens virtually the whole abdomen is honey yellow.

Stantonia carpocapsae, new species.

Immediately distinguished from the preceding species by the entirely yellow legs and the pale yellow stigma. Agrees with the foregoing description except in the following particulars:

Female.—Antennae 46-segmented; notauli only weakly punctate; first abscissa of radius three-fourths as long as first intercubitus; inner calcarium of posterior tibia a little more than half as long as metatarsus; first abdominal tergite not distinctly three times as long as broad at apex, at least one and one-half times as broad at apex as at base, the surface very faintly coriaceous. Antenna yellow, a narrow blackish mark on outer side of scape black; apical third of flagellum brownish black; abdomen entirely honey yellow; stigma transparent yellowish, veins pale brown; all legs entirely honey yellow.

Type locality.—Western Kentucky.
Type.—U. S. National Museum No. 52640.
Host.—*Carpocapsa pomonella* (L.).

Described from a single female recorded as having been reared from a cocoon of the codling moth in June, 1927, and received from Paul O. Ritcher, of the University of Kentucky.

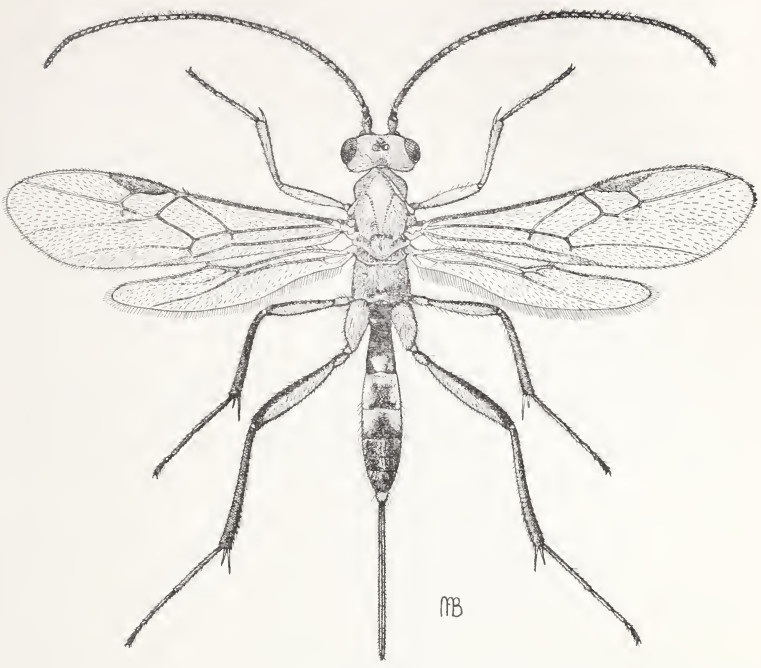


Fig. 1.—Female of *Stantonia lamprosemae*, new species. Drawn by Mary F. Benson, of the Bureau of Entomology and Plant Quarantine.

EDITORIAL COMMENT—"THE HUMAN FLEA."

A recent admirable issue of published information entitled "How to Control Fleas" has served to arouse one of the editor's lurking etymological aversions, viz: "the human flea."

Now, candidly speaking, there is not the remotest spark of humanity about a flea. Most indisputably his inhumanity to man makes countless thousands scratch. The species of flea commonly addicted to *Rattus rattus* is very properly termed "the rat flea" and likewise Tabby's saltatorial companion is the "cat flea." Conversely, Towser's entomological stimulus to a more active life never is termed the "canine flea." Why, then, should that damnable atom of pulicarious iniquity *Pulex irritans* be even verbally endowed with humanity? Why is he not the "man flea"? —Editor.

GENERAL CATALOGUE OF THE HEMIPTERA, FASCICLE IV, FULGOROIDEA, PART 2, CIXIIDAE, by Z. P. Metcalf, 8 vo., paper, 269 pp., Smith College, Northampton, Mass., 1936.

This, the most recent addition to the extensive catalogue of the Hemiptera which began publication in 1927, under the editorship of G. Horvath and H. M. Parshley, embraces the family Cixiidae and follows closely the plan of the previous fascicles. In the brief introduction the characters of the family are described, a historical resumé is given, and the geographical distribution of the family is outlined.

"The family is divided into tribes, and the genera are arranged under the tribes in as near a phylogenetic order as our present knowledge will permit. . . . A catalogue is not a revision of a group and the location of the genera and species in the present catalogue is merely an attempt to reflect what is believed to be the general consensus of the best authorities at the present time." An extensive synonymy is included and indices of "New Names Proposed," "Genera, and Higher Groups" occur at the end of the volume. It is stated that a "Bibliography and specific index will appear in the last Part of the Fascicle." —W. R. W.

Actual date of publication, March 22, 1938

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PROCEEDINGS OF THE
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TWO NEW GENERA AND ONE NEW SPECIES OF SIPHONAPTERA.

By H. E. Ewing,
Bureau of Entomology and Plant Quarantine.

In the present paper two new genera and one new species of fleas are described. One of the new genera is based on a species described by Jordan in 1928, from China, and the other is based on a new species described in this paper from western United States. The type slides of the two type species involved are in the collection of the United States National Museum.

MICROPSYLLOIDES, new genus.

Forehead with broadly rounded free margin; frontal tubercle minute, vestigial; frontal notch absent. Genal comb almost vertical, with 4 dark spines, the upper 2 situated near antennal groove. Genal lobe ending in a pale spinelike process resembling a spine of genal comb. Labial palpus reaching beyond apex of trochanter I, composed of 8 segments.

Thorax medium sized; pronotum shorter than metanotum, with a comb of numerous, dark spines. Mesosternum fused, without demarcation, with mesepisternum; mesepisternum separated from mesepimeron by an internal vertical ridge. Upper sclerite of metepisternum fused with metanotum.

Abdomen rather large; with a few apical spines near the median line on some of the tergal plates. Antepygidial bristles 2 on each side, medium in length, subequal. A single stout, vermiform receptaculum seminis present.

Legs rather weak. Hind coxa with a small patch of spinelets on inside near anterior margin. Last segment of each tarsus with 4 pairs of lateral plantar bristles.

Type species.—Rhadinopsylla jaonis Jordan.

Only the type species included. This genus is closely related to the peculiar genus *Micropsylla* Dunn and Parker, with which it agrees in having the upper sclerite of the metepisternum fused with metanotum. In Jordan's description of the type species (Jordan, 1929) he states that one labial palpus is composed of 8 segments and the other of 7. The writer has examined the type specimen of this species which is in the United States National Museum and finds that both palpi are 8-segmented. The palpi of the type specimen are pulled far apart, and it is

necessary to reverse the microscope slide in order to see one of them to advantage. It is unfortunate that only the female of this peculiar species is known.

TRICHOPSYLLOIDES, new genus.

Head rather short. Front with evenly and broadly out-curving margin. Frontal tubercle small, angulate, hyaline; frontal notch absent. Eyes absent. Palpus 5-segmented, not reaching apex of coxa I. Maxilla produced ventrally into a long, spinelike process. Antennal club short, segmenatation more distinct on posterior than on anterior side; setae on end of second antennal segment minute.

Pronotum shorter than mesonotum, with a single transverse row of setae. Pronotal comb composed of usual dark spines and occupying only part of posterior margin of pronotum. Mesepisternum separated from mesepimeron by an inner chitinous ridge. Upper sclerite of metepisternum fused with metanotum; metepimeron fused along upper part of anterior end with metepisternum.

Abdomen well clothed with stout, long setae; combs and apical spines absent. Antepygidial bristles absent. Sternal plate VIII of male large, broad, practically unmodified; sternal plate IX of male produced posteriorly into a pair of long, conspicuous lobes, each of which bears a ventral, subapical tuft of setae; movable finger of clasper an upturned hook.

Legs slender. Coxa III without a row or patch of spinelets on inside. Last segment of each tarsus with 4 pairs of lateral plantar bristles, none of them displaced toward middle line of segment.

Type species.—Trichopsylloides oregonensis, new species.

This new genus is nearest *Trichopsylla* Kolenati, from which it differs in the presence of a pronotal comb and the absence of eyes. A single species is included.

Trichopsylloides oregonensis, new species.

Forehead with a single row of setae, the ocular row. This row is composed of four setae arranged in a straight line, the uppermost being situated near anterior margin of antennal groove. Postantennal region of head with two rows of setae on each side. Two pairs of dermal pits on front, one pair immediately behind and above frontal tubercle and a submarginal dorsal pair. Pronotal comb with twelve spines, decreasing in length from top downward. Typical abdominal segments each with long dorsal and ventral setae arranged in two rather irregular and incomplete rows; middle lateral areas of abdomen bare.

Modified terminal abdominal segments of male as follows: Sternal plate VIII large and broad, with a few large ventral setae; sternal plate IX with long, truncate vertical process, extending upward to front margin of body of clasper. Manubrium of clasper extending downward beyond penis and ending in an anteriorly directed spinelike process; dorsal process represented by a broad, rounded lobe; 2 acetabular bristles on each clasper, situated submarginally below acetabulum; movable finger hooklike, scarcely reaching to upper margin of dorsal lobe of clasper and bearing a very long, subapical bristle on posterior

margin as well as two shorter, more ventral, marginal bristles. Tergal plate of anal segment slightly longer than pygidium, well clothed with setae.

Receptaculum of female with a cylindrical head about one and one-half times as long as wide and a sausage-shaped tail of about the same length. Stylet of almost uniform width for most of its length, without lateral setae but with two terminal setae, one about as long as the stylet itself and the other twice as long.

Length of male, 1.8 mm.; *greatest depth of abdomen*, 0.7 mm. *Length of female*, 2.7 mm.; *greatest depth of abdomen*, 1.2 mm.

Type host and type locality.—*Aplodontia pacifica*, at Delake, Oregon.

Holotype.—U. S. National Museum no. 51880.

Remarks.—One male (holotype) from type host, a mountain beaver, at type locality, June 24, 1933, by S. G. Jewett, Jr. (Bishopp no. 19194); one male and one female from "mountain beaver," Greathorn Creek, Columbia National Forest, Washington State, March 26, 1936, by Andy Roth (Bishopp no. 23413).

NEW SARCOPHAGINAE (DIPTERA).

By Harold C. Hallock.[1]

An extensive study of the Sarcophaginae of New York has been made during the past three years. Although the writer has examined over 2,500 specimens collected in New York State and more than 1,500 specimens from New England and eastern Canada, only two new species were discovered. After this manuscript was completed a description of one of these species (*Johnsonia borealis*) by Mr. H. J. Reinhard was received. As Mr. Reinhard had only two female specimens of this species a description of the male will be given in this paper. A description of a new *Sarcophaga* is given at this time and the type is deposited in the United States National Museum in order that a careful record of this species may be preserved.

These new species belong to the genera *Johnsonia* and *Sarcophaga*, which were placed in the family Sarcophagidae by Aldrich (1904), Williston (1908), Parker (1914), and Lopes (1936). Hall (1933) grouped these genera with some others in the Calliphoridae. Curran (1934) placed them in the Metopiidae. Townsend (1935), after an extensive study of material in European Museums, placed *Johnsonia* in the Melanophoridae and *Sarcophaga* in the Stephanostomatidae. Reinhard (1937) placed *Johnsonia* in the family Stephanostomatidae. At this time the writer is inclined to follow Williston and retain the family name of Sarcophagidae, at least until the group can be studied more extensively.

---

[1] Contribution from the Entomological Laboratory, Cornell University, Ithaca, N. Y.

JOHNSONIA Coquillett.

Coquillett, 1895. Proc. Acad. Nat. Sci. vol. 47, p. 316.

Hall (1933) pointed out that the diagnostic characters of this homogeneous genus were the setulose fifth vein and the long bristles on the cheeks.

The species of this genus are nearly all tropical or subtropical in their distribution. When Reinhard (1937) described *Johnsonia borealis* from two female specimens which were taken in Michigan and Ohio this was the first *Johnsonia* recorded from the northern states.

The following table, which has been modified from Hall (1933), separates the known species.

1.—Fourth abdominal segment entirely black ..... *lagunicula* Hall
Fourth abdominal segment partially or entirely reddish 2
2.—Pulvilli enlongate 3
Pulvilli normal 4
3.—Abdomen mostly red, legs red ..... *frontalis* Aldrich
Only fourth abdominal segment red, legs black ..... *borealis* Reinhard
4.—Fourth abdominal segment black on apical third or slightly more .... *bivittata* Curran
Fourth abdominal segment red on apical half or more 5
5.—Legs red or reddish ..... *elegans* Coquillett
Legs black ..... *setosa* Aldrich

JOHNSONIA BOREALIS Reinhard.

Reinhard, Bull. Brooklyn Ent. Soc. 32, pp. 62–74. (1937).

Male.—Head: front 0.369 of head-width; parafrontals and parafacials gray pollinose with a few scattering black hairs; frontal bristles about seven extending to base of antennae, anterior four pairs directed inward, the rest reclinate; a single proclinate fronto-orbital bristle situated close to the frontal row; frontal vitta dark reddish brown, wider than parafrontal on upper half; antennae black, third joint tinged with red basally and about twice the length of the second; arista with long plumosity for four-fifths of its length; antennae reaching nearly to the vibrissae, which are very long and at the oral margin; palpi and proboscis black; bucca less than one-fourth the eye-height; back of head with three rows of black bristly hairs; beard black except a few pale hairs near the neck.

Thorax gray pollinose with three black stripes; no anterior acrostichals; dorsocentrals 2, 3; sternopleurals 2; prescutellar bristles present; scutellum with two pairs of marginals, subapical and apical bristles very weak; infrasquamal hairs present; propleura and prosternum bare.

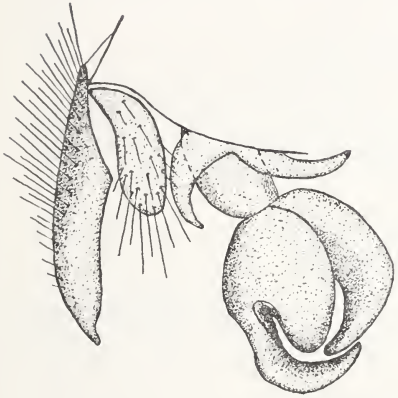
Abdomen gray tessellated except the fourth segment, which is red and with a narrow black margin at its base and a black triangle in middle extending half the width of the segment; first and second segments with laterals only, third and fourth segments with marginal row of bristles.



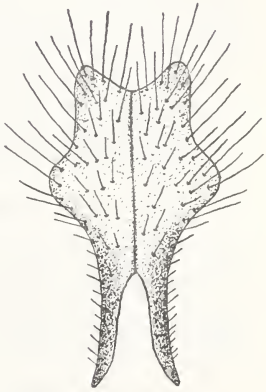
1



1A



2



2A

Explanation of Figures.

Fig. 1. *Johnsonia borealis* Reinhard. Right lateral view of hypopygial structures. 1a. Rear view of anal forceps.

Fig. 2. *Sarcophaga montanensis*, n. sp. Right lateral of hypopygial structures. 2a. Rear view of anal forceps.

Hypopygium red; anal forceps, claspers, and aedeagus black. Genital features as illustrated in figures 1 and 1a.

Wings hyaline; costal spine small, first vein with numerous setae, third vein with setae almost to crossvein, fifth vein with numerous strong setae; epaulets black.

Legs black, hind tibia without villosity, middle tibia with two anterodorsal bristles, pulvilli elongate.

Length, 8.5 mm.

Female.—As Reinhard (1937) gave an excellent description of the female only a few additional points will be mentioned. Fourth abdominal segment entirely

red or with a black margin; sternopleural bristles 0, 1; but one specimen has 0, 2 bristles on the right sternopleural sclerite.

Length, 6.5 to 10 mm.

Mr. D. G. Hall very kindly pointed out in a letter that *Johnsonia borealis* may be separated from the closely related form, *Johnsonia frontalis* Ald., by the "less elongate pulvilli, abdomen less extensively reddish (fourth segment only), and in having black legs instead of red." Mr. H. J. Reinhard very kindly compared a specimen of my material with the paratype and verified the determination.

This species has been found at the following localities: Poughkeepsie, N. Y., one male July 6, 1936, one female July 26, 1936 (Townes); Eberlys Mill, Pa., one female July 12, 1909 (Walton); Hamburg, Mich., one female June 3, 1934 (Steyskal); Brownhelm, O., Aug. 14, 1916 (Reinhard).

Dr. H. K. Townes has very kindly presented the male specimen, which was used in this description, to the United States National Museum so that it may be available for future study.

Holotype.—Female in the Univ. of Michigan Museum.

SARCOPHAGA Meigen.

Meigen, 1826, Syst. Beschr. Zwei. Ins., V. p. 14.

The following new species, which is a typical *Sarcophaga*, was received from Mr. David G. Hall and was collected in the Adirondack Mountains by Dr. J. M. Aldrich.

Sarcophaga montanensis, n. sp.

Male.—Head: front 0.181 of head width; parafrontals and parafacials gray pollinose, each parafacial with a row of long bristly hairs near the eye; frontal bristles fourteen, diverging in the lower four to beyond the middle of the second antennal joint; antennae black, arista with long plumosity for half its length; third joint two times the second, reaching almost to the vibrissae, which are long and at the oral margin; facial ridges hairy nearly half the distance to the base of the antennae; palpi and proboscis black, both normal; bucca about one-fourth the eye height, with numerous black hairs; three rows of bristly hairs back of eyes (the lower row irregular).

Thorax with the usual three to five black stripes; posterior dorcentral bristles four; acrostichals present in prescutellars only; sternopleurals three; scutellum with two pairs of marginals, one of subapical, and one of apical bristles.

Abdomen gray tessellated; first and second segments with laterals only; third and fourth segments with marginal rows of about ten bristles each. Fifth sternite divided, arms yellowish, with short black setae on the inside edges.

Hypopygium black except a slight reddish tinge on dorsum, covered with black hairs; first segment with a marginal row of twelve strong bristles; forceps, accessory plates and aedeagus black; genital parts as in figures 2 and 2a.

Wings hyaline; costal spine minute; third vein bristly nearly half way to cross vein.

Legs black; middle femur with comb below; hind tibia with moderately long hairs.

Length, 12 mm.

This species belongs to Aldrich's (1916) group E. It may be separated from *Sarcophaga houghi* Ald. by the absence of a conspicuous hump on the back of the aedeagus. The absence of several slender processes at apex of the aedeagus distinguishes this species from *Sarcophaga misera* var. *harpax* P.

Described from one male collected July 4 at White Face Mt., Adirondacks, N. Y., altitude 3800 feet (J. M. Aldrich).

Holotype.—Male, Cat. No. 52085, U. S. N. M.

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REVISION OF THE SUBFAMILY ONCERINAE WITH DESCRIPTION OF A NEW GENUS (COLEOPTERA: SCARABAEIDAE).

By Lawrence W. Saylor,

Bureau of Biological Survey, U. S. Department of Agriculture.

The beetles of this group are quite small and their distribution is rather localized in Southern and Lower California; these reasons probably account for the fact that adequate series have not heretofore been assembled and the true relationships of the species revealed. The availability of a small series of the rare *Nefoncerus convergens* and a large number of specimens of the commoner *Oncerus floralis* has induced the writer to study the taxonomy of the group with the result that he finds it necessary to remove them from their present systematic position.

Oncerus and the related new genus, herein described as *Nefoncerus*, are characterized mainly by having the labrum connate with the apex of the clypeus but on the same plane with the latter, and by the presence of the abdominal spiracles entirely in the membrane. These two genera can not be placed either with such other Laparastict scarabs as *Chnaunanthus* of the Chasmatopterinae, with *Aclopus* of the *Aclopinae*, nor with any other related subfamilies, mainly because of the radically different type of clypeal and labrum formation; all of these other subfamilies either have the mandibles large and exposed, the head and thorax armed with horns, or if the labrum be exposed it is small and inserted *under* the clypeus and *not* inserted at the apex of the clypeus and on the same plane with the latter, as is the case in *Oncerus*.

Oncerus and *Nefoncerus* are probably closest to *Aclopus* of the Aclopinae, but differ from the latter especially in having the labrum and clypeus on the same plane and the mandibles not visible from above, as well as such supplementary characters as the basically different type of tarsal claws (short and cleft, rather than long, slender and simple), the smaller eyes and the different facies.

Oncerus and *Nefoncerus* are also somewhat similar to the Melolonthine tribes Sericini and Liparetrini, but differ from the latter two in the matter of the spiracular arrangement and in most instances in the insertion of the labrum.

It may also be noted here that the tribe Liparetrini as listed in the Coleopterorum Catalogus is composed of many diverse elements and the whole tribe needs careful study. The Australian *Pachytrichia castanea*, for instance (having labrum inserted at apex clypeus and on the same plane, and the last abdominal spiracle inserted in a fold) is placed next to the American *Plectrodes* (having the labrum inserted so far back under the clypeus as to be invisible from above, and the last spiracle situated on the slight suture between the connate 5th ventral and the propygidial segments)!

Were it not for the different type of abdominal spiracle arrangement, *Oncerus* et al could be placed with *Phyllotocus* in the Sericini since this common Australian genus is quite similar in the insertion of the labrum, differing mainly in the type of claws and the often-carinate pygidium, as well as in the highly spinose type of hind tibiae. The genus *Cheiragra*, however, also Australian and placed right next to *Phyllotocus* has the labrum inserted under the clypeus, so that it appears as though many former students of the scarabs had somehow overlooked the importance of the insertion of the labrum.

It being impossible to satisfactorily place the genera *Oncerus* and *Nefoncerus* in any of the known subfamilies it becomes necessary to designate a new one for them, and this may be

known as the subfamily ONCERINAE, characterized by having all the abdominal spiracles in the membrane, the labrum inserted at the apex of the clypeus and on the same plane, the claws short and cleft (variously modified in one species) and the abdominal segments either connate or free.

The only two genera known definitely to belong in the new subfamily may be separated as follows:

(The males are more slender and have the abdomen flattened or concave in side view, whereas the females have the abdomen convex and the general habitus much more robust.)

Front tarsal claws male similar to each other and to those of female and simply cleft, no basal dilation; abdominal segments, except last, closely connate and sutures hardly or not discernible; hind tibiae 1½ times longer than widest point, the spurs inserted *at* apex, and on inner, lower margin; clypeus with sides parallel or slightly convergent basally. (California.) ..... *Oncerus.*

Front claws male strongly dissimilar to each other and to those of female hind and middle claws with large basal dilation, thus appearing tridentate; abdominal segments entirely free, sutures strong; hind tibiae nearly 3 times longer than wide, the spurs inserted definitely *before* the apex and on the outer, upper margin; clypeus with sides strongly convergent apically. (Lower California.) ..... *Nefoncerus.*

Oncerus floralis Leconte.

(Figure 1, a–d.)

Oncerus floralis Leconte, Jour. Ac. N. S. Phila. (2), III, 1856, pg. 284; Dalla Torre, Junk Col. Cat. pars 45, pg. 7. 1912.

Head and thorax piceous, elytra testaceo-castaneous. Clypeus extremely coarsely punctured, and tumid at middle; front coarsely punctured in apical half, basal half and vertex smooth. Thorax moderately coarsely, irregularly and sparsely punctured. Elytra covered with very long, rather dense hair. Length 3. to 3.8 mm.

The only described species in this genus can be taken in moderate abundance in the southern Californian desert regions early in the year, on all types of flowers. Found commonly on *Malocathrix glabrata* flowers by McKenzie and Timberlake in Borego Valley on March 20. Occurs to San Diego, and apparently known only from California. The author has examined well over a hundred examples and little or no variation occurs in the species that he has noted.

NEFONCERUS Saylor, new genus.

Oblong-oval, sparsely pilose above. Ligula separate from mentum. Labrum prolonged beyond apex of clypeus and on the same plane with the latter. Head with clypeus rapidly narrowed apically, suture distinct; eyes moderate, not

prominent. Antennae 9-segmented, club 3-segments, antennal club small and subglobose. Thorax transverse, sides subarcuately rounded, hind angles very broadly rounded, front angles subangulate; front margin slightly membranous. Abdominal segments free, not at all connate. Front outer claws male strongly dissimilar, and unlike those of the hind and middle legs; all claws of female similar. Middle and hind tarsal claws with large acute basal dilation, thus appearing tridentate. Otherwise as in *Oncerus floralis*.

Genotype.—Oncerus convergens Horn.

While appearing somewhat similar to *Oncerus floralis* in some of the characters, the presence of marked sexual dimorphism in the claws of one species and not in another, correlated with the great differences in the basic tibial, claw and abdominal structures, necessitates the separation of *O. convergens* into another genus. The hind tibiae of *Nefoncerus* in proportions, and manner and placement of the hind tibial spurs differ noticeably from those of *Oncerus floralis*, as may be readily seen from the key. While it may be pointed out that the connate condition of the abdomen, the shape of the clypeus, etc., are not good generic characters, the author feels that the placement of the tibial spurs on entirely different areas of the tibiae, correlated with the sexual dimorphism as exhibited in the front claws, and the different facies, makes the separation of *O. convergens* from *O. floralis* more or less obligatory.

Nefoncerus convergens (Horn).

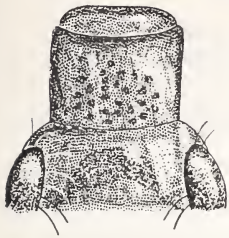
(Figure 2, a–e, Plate 11.)

Oncerus convergens Horn, Proc. Cal. Ac. Sci., ser. 2, IV, 1894, p. 394.

Head with clypeus and front very coarsely punctured, pilose. Thorax rufous, densely coarsely punctured over the entire surface, the hind angles very broadly rounded. Front tibiae with a very sharp submedian tooth; tarsi as in the figures, the hind and middle tarsi similar to each other. Elytra with somewhat sparse, short, subprocumbent hair. Length 4 mm.

The writer has examined 7 specimens of this rather rare and localized species, all from Lower California: San Jose del Cabo and Calmalli Mines, collected by Hubbard & Schwartz, and by Chas. Fuchs. The brief description as given above correlated with the key and accompanying figures, should enable one to readily place this species.

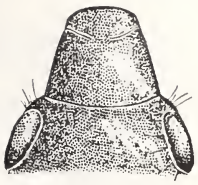
The writer is indebted to Dr. E. A. Chapin of the U. S. National Museum for helpful suggestions and the loan of material, as well as to Dr. E. C. Van Dyke for the use of the material in the California Academy of Sciences.



1 a



1 d



2 a



1 b



2 e



2 b



1 c



2 d



2 c

Explanation of Figures.

Figure 1: *Oncerus floralis* Leconte
Figure 2: *Nefoncerus convergens* (Horn)
a: Head, dorsal view
b: Inner view of hind tibiae
c: Male genitalia
d: Front inner male claw.
e: Front outer male claw.

A NEW GENUS AND SPECIES OF THE SUBFAMILY TRIATOMINAE (REDUVIIDAE: HEMIPTERA).

By H. G. Barber,
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

PARATRIATOMA, new genus.

Head elongate oval, scarcely shorter than pronotum, vertex very convex; eyes rather small, not strongly projected, each much narrower than width of vertex; preocular region distinctly longer than postocular, transversely impressed behind the strongly elevated tylus, devoid of an arcuate preocellar sulcus. Ocelli slightly elevated, widely separated. Antennae inserted closer to eyes than to apex of head, formed as in *Triatoma;* basal segment short, not quite reaching to apex of head. Rostrum stout, nearly straight, apposed to venral surface of head. Pronotum somewhat wider than long; the transverse impression placed well before the middle; disk of anterior lobe strongly, convexly elevated on each side of a deep longitudinal impression; posterior lobe with a median, longitudinal, shallow impression bounded on each side by a low rounded ridge. Scutellum devoid of a discal depressed area, prolonged into a cylindrical, apical process. Prosternum longitudinally sulcate. Legs rather short, scarcely incrassate, mutic; anterior tibia devoid of an apical spongy fossa. Entire body and the appendages sparsely covered with long, coarse hairs.

Type of the genus *Paratriatoma hirsuta*, new species.

The genus *Paratriatoma* is most closely related to *Triatoma*, from which it may be distinguished by the ovoidal shape of the head, the absence of an arcuate interocellar sulcus, the absence of femoral spines or tubercles, and particularly in the remarkable hirsuteness of the body and of the appendages.

Paratriatoma hirsuta, new species.

Narrowly oval; hirsute; slightly shiny; sordid ochraceous, scutellum and disk of the corium slightly infuscated, legs stramineous. Head with numerous long, coarse, curved, black hairs; the strongly convexed interocular region or vertex nearly four times as wide as an eye; dorso-ventral length of eye much shorter than corresponding dimension of head, the two eyes widely separated on the gula; anterior region before antenniferous tubercles with lateral margins not parallel but gradually converging anteriorly to apex of juga; preocular lateral margin to apex of antenniferous tubercles somewhat shorter than postocular margin, the latter, as seen from above, very slightly convex and abruptly contracted to collum. Ocelli large, slightly elevated, each situated behind inner margin of an eye. Antenna with basal two segments covered with proclinate, black hairs which on the second segment are much longer than the width of the segment; basal segment not quite reaching apex of head, a little more incrassate than second segment, which is about three times as long as basal; last two segments slender, with scattered, fine, oblique hairs which are three or four times as long as the width of the segments. Rostrum sparsely hirsute; apex attaining middle of prosternal sulcus; basal segment over one-half as long as second, third segment nearly one-half as long as second. Pronotum posteriorly nearly one-third wider than long; the outer anterior angle slightly produced in an

obtusely rounded tubercle; lateral margin of posterior lobe, anteriorly, lightly inpressed; humeral angles bluntly rounded. Scutellum somewhat elevated, disk roughly corrugated, cylindrical apical process about as long as remainder of scutellum. Connexivum immaculate, dorsally narrowly exposed beyond costal margin of corium, ventrally very narrowly exposed beyond lateral margins of ventral sclerites. Femora and tibiae with long, inclined, black hairs, denser on tibiae. Length 13–14.5 mm.

Type male, U. S. National Museum, Cat. No. 52747, Mojave, Calif., Aug. 23, 1935 (J. W. Vernon). Paratypes: Two males, Phanton Ranch, Grand Canyon, Ariz., May, 1929 (Vernon Bailey); female, with the same data as type; one nymph, Phanton Ranch, Grand Canyon, Ariz., May 1929 (Vernon Bailey) and two nymphs, Shoshone, Calif., April 1921 (H. J. Lind).

Nothing is known concerning the habits of this species beyond a report from J. W. Vernon that the specimens from Mojave had attacked man.

SEX DETERMINATION IN THE HONEYBEE.

By W. J. Nolan.

The story of sex determination in the honeybee is linked with the name of Dzierzon, who about eighty years ago established the fact that drones can arise from unfertilized eggs and that queens and workers arise from fertilized eggs. His results, obtained by crossing the yellow Italian with the European brown bee, indicated that this is the only way in which male and female bees are produced.

Final evidence that the drone arises only from unfertilized eggs and the female from fertilized eggs seemed to be given by Nachtsheim's cytological study of the European brown bee, in which he showed that the drone has only the haploid number of chromosomes whereas the female has the diploid number. Nachtsheim also set forth the view that sex in the bee is determined by the number of X chromosomes present, one X chromosome causing a male to develop and two X chromosomes a female.

The foregoing ideas are not entirely in accord with certain more recent findings in the honeybee or in the hymenopteran *Habrobracon juglandis* Ashm., nor do they permit the explanation of sex determination in the honeybee on the basis of modern genetic conceptions regarding other forms. Thus, although the development of males from unfertilized eggs remains unques-

tioned, evidence has been found that in a South African variety of the honeybee females likewise can develop from unfertilized eggs.

The finding of biparental males in *Habrobracon juglandis* leads to the question as to whether male honeybees do not also occasionally develop from fertilized eggs. The finding, in the experimental apiary at Beltsville, Md., of a drone termed a haplodiploid male mosaic by the *Habrobracon* geneticist Whiting is of considerable interest in this connection, since, if this drone does possess some diploid tissue, it seems the nearest approach to a diploid male yet recorded for the honeybee. Instead of having hairs of the same color on both sides of its thorax, the usual characteristic, this drone was strikingly marked by having only hairs of a moleskin color on the left side in contrast to yellowish hairs on the right. Judging from the appearance of the worker daughters, the mother of the drone had apparently mated with a drone somewhat darker than herself. The genetic explanation of the drone, however, has not yet been worked out. That the specimen was not a gynandromorph, or an intersex form, was shown by the fact that it bore only male appendages and its internal organs were male.

Cytological, or even genetic, identification of the sex chromosomes in the honeybee still remains to be accomplished. In contrast to Nachtsheim's view concerning the honeybee, Whiting maintains that in *Habrobracon* the female is of the XY instead of the XX type and, further, that the haploid males are of the X and Y types and the biparental males of the XX and YY types. These four male types look alike but are distinguishable genetically. To account for the determination of sex he ascribes the possession of a pair of factors, F. g., to the X chromosome while the Y chromosome possesses their allelmorphs f. G. The presence of both F and G is necessary for the formation of a female, a condition that results in the union of X and Y.

The modern theory of genic balance has also caused sex determination in the honeybee to appear more of a puzzle than formerly, since according to this theory it is not the sex chromosomes alone that determine maleness or femaleness but the resultant effect of genes for maleness and genes for femaleness found not only in the sex chromosomes but in the autosomes as well. Some investigators include the cytoplasm as a third factor in sex determination. According to the theory of genic balance, sex determination in the honeybee can not be explained on the basis of the fact that there is only one X chromosome in the drone and two X chromosomes in the female, for the proportion of X chromosome to autosome material is the same in each case, since not only the X chromosome but also the autosome content of the female is held to be double that of the male.

Even the cause of the sex ratio in the honeybee colony has

been given no satisfactory explanation as yet, although various reasons have been advanced for the preponderance of adults developed from fertilized eggs. The belief that the size of cell causes the queen, in egg laying, to bend her body in such a way as to shut off or induce the escape of sperm from her spermatheca has been disapproved by common beekeeping experience, because drones develop from eggs laid in the smaller worker cells as well as in the normal drone cells.

Experimental breeding work to determine definitely the nature of sex determination in the honeybee will be greatly facilitated by the discovery of some easily recognized mutation. In the meantime the question demands a further cytological study of the honeybee.

SOME CHARACTERISTICS OF BACILLUS LARVAE IN CULTURE AFTER EXPOSURE TO LETHAL AGENTS.

By C. E. Burnside.

American foulbrood, caused by *Bacillus larvae*, is the most serious disease that affects honeybees. Infected colonies practically always die, and burning them is the only dependable treatment known. The causative organism does not grow on the usual nutrient media, but can be cultured when unheated egg yolk and extracts from certain plants, especially carrot, are added to the medium. In such media containing carrot extract but no nitrates *B. larvae* stores nitrites, whereas the usual contaminating organisms do not. This provides a fairly accurate chemical test for identifying *B. larvae*. When favorable medium is inoculated with not less than 500,000,000 spores, a fairly luxuriant growth develops within 48 hours. As the amount of inoculum is reduced the lag period is increased, and with less than 50,000 spores no growth occurs on egg-yolk agar.

During the past 30 years various disinfecting and sterilizing agents for destroying *B. larvae* have been tested. In the earliest cultural tests treated spores that failed to germinate within 48 hours were considered killed. Boiling in water for 5 to 11 minutes was thought to destroy all spores of *B. larvae*. Resistance to boiling in honey was reported to be slightly greater and resistance to moist heat under pressure a little less. Early tests showed that *B. larvae* is highly resistant to several common chemical disinfectants. Formaldehyde was found to be the most effective, and for a number of years water and alcohol solutions of this chemical were widely used by beekeepers for disinfecting combs and other equipment from diseased colonies. Disinfection was supposed to be complete after 48 hours' exposure to a 20-per cent aqueous solution of formalin. The method eventually proved unreliable, however, and has since

been abandoned in favor of burning. The efficiency of disinfecting agents was usually tested with cultures on egg-yolk agar or by inoculating colonies of bees.

In more recent experiments, using improved media and incubation up to 30 days, new conceptions have been obtained of the resistance of *B. larvae* and the characteristics of the cultures after subjection to lethal agents. By the old method of testing the dead larvae after treatment with formalin solution retained paraformaldehyde, which often inhibited or prevented growth of *B. larvae*. A method of washing now in use at the Bee Culture Laboratory removes all formaldehyde or other chemicals before cultures are prepared. Spores of *B. larvae* that had been exposed to 20-per cent formalin solution for 3 days and washed before being placed in culture gave growth after prolonged incubation. No growth was obtained with spores that had been treated for 4 days. Sublethal exposure to formaldehyde increased the lag period of spores in culture ranging from slight delay in germination up to 30 days in some instances. In general the lag period increased with the period of exposure.

There was a marked and unexplained variation in cultural results with treated spores. With similarly treated spores growth in culture ranged from very slight to luxuriant, with no growth in some cultures after 30 days' incubation. In most of the tests the inoculum consisted of one scale of about 2,500,000,000 spores. Increasing the inoculum beyond one scale appeared not to reduce the lag period, increase the luxuriance of growth, or affect the variation in cultural results. Sublethal exposure of *B. larvae* to chlorine, copper sulfate, mercuric chloride, potassium hydroxide, sodium hydroxide, and commercial lye was found to affect the lag period and growth of spores in culture in practically the same manner as does formaldehyde.

When improved media, prolonged incubation, and large inoculums were used, the resistance of *B. larvae* to heat was found to be much greater than was formerly supposed. In some instances spores resisted boiling in water for 5 hours, autoclaving at 15 pounds' pressure for 25 minutes, dry heat at 98° C. for 46 hours, and melted beeswax at 100° C. for nearly 5 days. The variation in lag period and luxuriance of growth of heated spores was extreme. In general the lag period increased and the luxuriance of growth was reduced as the time and temperature were increased.

Variations in cultural results with spores from different sources suggested differences in resistance, but the equally great variations in cultures prepared with spores from the same source made it difficult to detect differences in resistance. Extreme variation in results, for which we have no explanation as yet, has made it impossible to establish the minimum period

of heating required to destroy all spores of *B. larvae*. The results indicate that the effect of lethal agents on the spores is a gradual weakening and destruction. Although inoculums of more than 2,500,000,000 treated spores did not seem to decrease the lag period or increase the number of positive cultures, in most cases much smaller inoculums did increase the lag period and reduce the number of positive cultures. An Italian investigator, in testing the resistance of *B. larvae* to heat, used inoculums of about 2,000,000 spores and reports a much lower resistance than is indicated by our experiments. It is thought that the difference may be explained by the difference in the amount of inoculum.

Tests on the inoculation of colonies indicate that sublethal heating of *B. larvae* spores destroys or greatly reduces their virulence and that spores capable of growing in culture may not produce disease when fed to colonies.

A NEW GENUS AND SPECIES OF THYSANOPTERA FROM GREENHOUSES.

By J. C. Crawford,
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The discovery of a new greenhouse pest is always a matter of interest, and the new species described below was found throughout the large series of houses known as Range 1 of the New York Botanical Gardens, where it was taken on many plants and was present in great numbers, being by far the most abundant thrips present. In fact, the different species ordinarily known as the common greenhouse thrips were very rare.

ASPROTHRIPS,[1] new genus.

Belongs to the Dendrothripini. Head excavated in front, antennae 8-jointed with a short 2-jointed style, antennal joints 5 and 6 closely united and with 7 and 8 forming a compact mass; maxillary palpi 3-jointed; trichomes on segments 3 and 4 U-shaped; wings very narrow, practically pointed at tips, fore wings almost straight along posterior margin (not like those of typical Dendrothripini in shape), with a thin costal fringe of hairs in apical five-eighths, these arising almost from costa itself, no bristles on costal margin, anterior wings with two veins, fore vein with no (usually) or with one apical bristle, hind vein with about four widely-spaced bristles; all major setae and wing bristles markedly reduced, being mostly minute, with those on apical margin of prothorax and apical abdominal segments short; paired median bristles on abdominal segments not close together; comb on abdominal segments not developed; paired mediodorsal bristles on tergites 2–8 small, not close together.

[1] $\alpha\sigma\pi\rho os$ = white (modern Greek).

Type.—*Asprothrips raui* Crawford.

In the Dendrothripini this genus is near *Dendrothrips* but differs from it in the very narrow, pointed, not dendrothripine wings, in the fringe hairs of fore wings arising close to costa instead of far back of it, in the less excavated head, in the marked reduction in size of all major bristles, and in the paired median bristles of abdominal segments 2–8 not being close together.

From *Pseudodendrothrips*, also, it differs by the short style, the lack of long pronotal bristles, and the lack of long posterior tarsi. *Aneurothrips* has the fore wings veinless and the surface without bristles; *Metaxyothrips* has the head produced in front; *Hydatothrips* has the single vein of the fore wings uniformly set with bristles, a comb on sides of tergites 1–6 and complete ones on 7–8.

Asprothrips raui, new species.

Female (macropterous).—Length (slightly distended) 1.1 mm. Very light yellowish-white including basal antennal segments; ocellar pigment bright red; eyes black; tip of antennal segment 4 light brown, 5–8 dark brown, with 5 lighter at base; all bristles colorless and hard to see.

Head with anterior ocellus directed forward; eyes protruding and with large facets, pilose; head (from front of eye) 80 mu long, 140 mu wide; ocelli in an equilateral triangle remote from eyes, postocelli about as far from eyes as from each other; all bristles on head minute, outer postocular seen in outline about 6 mu long; mouth cone short, hardly reaching middle of prosternum; antennal joint 3 with a long pedicel, 4 and 5 with short pedicels; length of antennal segments in mu:

1 (visible portion)	2	3	4	5	6	7	8
20	32	36	34	31	33	8	12

Prothorax about 130 mu long, 186 mu wide, delicately transversely lined, post margin with 4 short (12 mu) bristles on each side; wing veins faint, bristles on them reduced to setulae not much longer than those on surface of wings; basal one-third of fore wing without surface setulae; fore vein with no (usually) or one apical bristle, hind vein with about four widely-spaced bristles hardly 6 mu long; fore wings about 633 mu long, median width 32 mu, almost straight along posterior margin beyond basal curve. Pterothorax wider than prothorax, sides gently curved, 260 mu long, 240 mu wide.

Abdomen delicately reticulated; no comb on tergites, disks of abdominal segments with two pairs of short spines, median pair on segment 7 about 25 mu apart, lateral pair 18 mu from median pair; ninth segment with an apical row of four pairs of spines of which the median pair is longer (22 mu) and stronger than the others and about as long as the lateral subapical pair, and the two pairs on tenth segment.

Male (macropterous).—Length (distended) 1.0 mm. Very similar to the female but with the fifth antennal segment light in basal half.

Type locality.—New York, N. Y., in greenhouses.

Host.—Palm (female holotype, Nov. 21, 1936, G. J. Rau, Coll.). Anthurium sp. (male allotype, Dec. 6, 1936, J. C. Crawford, Coll.).

Type.—Cat. No. 52354, U. S. National Museum.

Many female paratypes taken December 6, 1936, to January 7, 1937, by the author, commonly on *Carludovica atrovirens*, *Bactris utilis*, *Alocasia odora*, *Aglaonema modestum*, and sparsely on many other plants in greenhouses in the New York Botanical Gardens, where it is a rather serious pest. The male allotype is the only specimen taken of that sex.

This species is dedicated to Mr. Rau, who first collected it, as well as other greenhouse thrips.

Paratypes have been deposited in the collection of Dr. H. Priesner, who confirmed my finding that it was new, both generically and specifically. Other paratypes in my collection.

MINUTES OF THE 489th REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 489th meeting of the Society was called to order at 8 P. M., Thursday, February 3, 1938, by President E. A. Back, in Room 43 of the National Museum. Thirty-six members and thirteen visitors were present. The minutes of the previous meeting were read and approved.

Under Notes and Exhibition of Specimens, Austin H. Clark called attention to the fact that the figure of *Danais plexippus* (L.) in Dr. Holland's "Butterfly Book" (pl. 7, fig. 1) does not represent the North American migratory form of this species—typical *plexippus*. At his request Dr. Ralph L. Chermock and Dr. Hugo Kahl were so kind as to look up the specimen figured, which is in the Carnegie Museum at Pittsburgh. They found that it was labeled "*Danais erippus*, South America," and was purchased from Dr. O. Staudinger. It agrees minutely with a specimen from Salvador in the National Museum and represents the form *nigrippus* Hsch. from Central and northern South America, though it is not wholly typical.

Mr. Clark also noted the great abundance of the canna leaf-folder, *Calpodes ethlius* Cram., in Virginia during the past summer. He personally found the larvae in fifty cities and towns in sixteen counties, all in the coastal plain. In many places, especially near the sea and near Chesapeake Bay, it did much damage. Larvae were very common at Alexandria and between Alexandria and Washington, and many were found on the cannas in the Department of Agriculture grounds. (Author's abstract.)

F. C. Bishopp called attention to the Third North American Wild Life Conference, to be held at Baltimore, Md., February 14–17, 1938.

E. A. Back described an interesting case of injury, caused by a scolytid beetle, *Pterocyclon fasciatum* (Say), to brine barrels in a pickle factory. Materials were exhibited which demonstrated how the beetles make holes in the barrels, allowing leakage of the brine.

The following persons, having been duly recommended by the Executive Committee, were unanimously elected to membership in the Society:

L. G. Baumhofer, Division of Forest Insect Investigations.

William H. Bennett, Department of Forest Entomology, the New York State College of Forestry at Syracuse University, Syracuse, N. Y.

Samuel C. Billings, Insecticide Division (Testing Section), Food and Drug Administration, Beltsville, Md.

B. D. Burks, Illinois Natural History Survey, Urbana, Ill.

Mrs. Abby H. Casanges, Division of Control Investigations.

Percy Jones, Division of Control Investigations.

Randall Latta, Division of Control Investigations.

Miss Janet Mabry, Division of Insect Pest Survey and Information.

Elmer L. Mayer, Division of Control Investigations.

S. C. Munson, Division of Control Investigations.

Miss Gertrude Myers, Division of Insect Pest Survey and Information.

L. W. Orr, Division of Forest Insect Investigations.

Miss Helen Sollers, Division of Insect Pest Survey and Information.

The first speaker on the regular program, James M. Brennan, presented an illustrated talk, entitled "Some indications of the taxonomic value of the male genitalia of Tabanidae." The dipterous family Tabanidae, represented by 2,500 or more described species, has, because of the reported lack of characters, always been somewhat of a bane to the taxonomist. Color characters have been used extensively for separating closely related species, but in many species the range of variation in color pattern is so great as to make it utterly worthless. Structural characters, principally derived from the head and its appendages, have been useful in formulating generic concepts within the group, but little application of structures has been made to species.

Present investigations show, however, that at least within some genera, successful application of the external male genitalia can be made to the taxonomy of Tabanidae, and that certain structures involved do have definite diagnostic value in separating species.

In *Stonemyia* Brennan (1935), a small genus comprising six good species, valid diagnostic characters were found principally in the shape of the claspers of the external male genitalia. Likewise the form of the ninth tergite was found to be fairly reliable as a supplementary character.

Representative species of six other genera have been studied but thus far the evidence is insufficient to permit of more than general statements. However, it is apparent that the external male genitalia are important in establishing generic relationships.

It is likewise indicated that the male genital structures do not have taxonomic significance within all groups of the Tabanidae.

The method of preparing specimens for study involves the simple technique of snipping off the abdominal tip, relaxing and clearing in 10% caustic, dissecting out the hypopygium, and clearing further if necessary. The structures, because of their depth, various curves, projections, and angles do not lend themselves readily to a slide mount, hence are studied in a drop of glycerine or glycerine jelly. (Author's abstract.)

George G. Becker gave an interesting talk, entitled "South African insects of plant quarantine interest." He discussed some of the insect problems of South Africa, devoting the major part of his talk to the handling of South African deciduous fruits which are to be shipped to the United States under the provisions of the Bureau's circular B. E. P. Q.—464. The discussion was illustrated with slides showing the character of some of the fruit producing areas of South Africa, and the equipment and methods of handling fruit in the large Government-owned cold storage plant at Cape Town. (Author's abstract.)

Discussion followed by Sasscer and Wade.

The last item on the regular program was in the form of two book reviews by A. B. Gurney:

Genetics and the Origin of Species. By Theodozius Dobzhansky. New York: Columbia University Press. 1937. 364 pp.

This book on the evolution of species, written by Professor Dobzhansky of the California Institute of Technology, will interest workers in many fields of biology. A Russian by birth and training, and well acquainted with the problems of insect taxonomy although primarily a geneticist, Professor Dobzhansky presents "a discussion of the mechanisms of species formation in terms of the known facts and theories of genetics." The reader need not have an extensive background in genetics to appreciate the importance of the principles discussed.

The first of the ten chapters, Organic Diversity, emphasizes the discontinuity of living things and the importance of the non-blending unit of inheritance: the gene. The second defines the term "mutation" as a change in a gene, and discusses the occurrence of mutations. This definition differs from that of many authors who use a broader interpretation involving numerical and structural chromosomal changes in addition to simple gene changes. Three chapters discuss translocation, inversion, polyploidy and other types of chromosomal changes and their bearing, together with that of mutations, on the origin of races and species. One chapter is devoted to Variation in Natural Populations and three concern certain of the more important phenomena which enable races and species to evolve as distinct populations once change has occurred: Selection, Isolating Mechanisms, Hybrid Sterility. The last, Species as Natural Units, includes the definition of a species "as that stage of evolutionary process at which the once actually or potentially interbreeding array of forms becomes segregated in two or more separate arrays which are physiologically incapable of interbreeding." Although time on a geological scale may be necessary for significant change to be apparent, a species is thus seen to be a stage in a dynamic process, "not a static unit." Species reproducing mainly vegetatively or asexually are often characterized by differences which are much less than those distinguishing most bisexual organisms.

Because of the difficulty, often the impossibility, due to lack of biological data, of determining whether a given population contains several distinct species or several races of only one species, the personal judgment of a taxonomist will continue to be important. It may be hoped, however, that an appreciation of Professor Dobzhansky's conception of species will lead to a better understanding of the problems of systematic biology.

The Origin of Higher Categories in Cynips. By Alfred C. Kinsey. Bloomington, Indiana: Indiana University Publications. 1936. 334 pp.

This publication is a continuation of the work presented by Professor Kinsey in 1930, entitled "The Gall Wasp Genus Cynips, a Study in the Origin of Species." Aside from the purely taxonomic matter contained, the work is of unusual interest because of the large number of specimens studied and the author's efforts to analyze the evolutionary factors active in the Cynipidae and to understand the nature of species, genera and still higher categories in terms of natural processes. He concludes that species are realities in Nature, but that higher categories are arbitrarily delimited sections of phylogenetically continuous chains of species.

It should be noted that the units treated as species correspond to the races or subspecies of many authors. Professor Kinsey believes that species usually arise by mutation and subsequent isolation in the case of *Cynips;* this is in agreement with Professor Dobzhansky's recent work, but the various types of mutation are not discussed in detail, while Professor Dobzhansky attaches the greater importance to gene changes as opposed to chromosomal changes. (Author's abstract.)

Adjournment at 10.15 P. M.

ASHLEY B. GURNEY,
Recording Secretary.

MINUTES OF THE 490TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 490th meeting of the Society was called to order at 8 P. M., Thursday, March 3, 1938, in Room 43 of the National Museum, with President Back presiding and thirty-one members and six visitors present. The minutes of the previous meeting were read and approved.

F. W. Poos presented the names of the following individuals, who, following the motion of N. E. McIndoo, were unanimously elected to membership in the Society:

J. A. Beal, Division of Forest Insect Investigations, Bureau of Entomology and Plant Quarantine, Fort Collins, Colorado.

William E. Bickley, Department of Entomology, University of Maryland, College Park, Md.

L. P. Ditman, Department of Entomology, University of Maryland, College Park, Md.

Neale F. Howard, 151 West Eleventh Avenue, Columbus, Ohio.

Paul Knight, Department of Entomology, University of Maryland, College Park, Md.

Mrs. Margaret C. Mansuy, Division of Insect Identification, Bureau of Entomology and Plant Quarantine, Washington, D. C. (Reinstatement.)

Roy H. Nagel, Division of Forest Insect Investigations, Bureau of Entomology and Plant Quarantine, Milwaukee, Wisc.

Alfred B. Pettit, Department of Entomology, University of Maryland, College Park, Md.

Miss Virginia E. Thomas, Department of Entomology, University of Maryland, College Park, Md.

V. L. Wildermuth, Division of Cereal and Forage Insect Investigations, Bureau of Entomology and Plant Quarantine, Tempe, Ariz.

R. A. Cushman discussed a gynandromorph ichneumonid (*Delomerista* sp.) which exhibited imperfectly formed genitalia of both sexes. (Author's abstract.)

E. A. Back exhibited an historic book, badly infested by beetles, which had recently been sent to him from Florida. The beetle has been described by W. S. Fisher as a new genus and species of Anobiidae, *Neogastrallus librinocens*.

The regular program consisted of a symposium on bee culture, the first talk being by J. I. Hambleton, entitled "Work of the Division of Bee Culture." Dr. Hambleton outlined the different types of investigation done at the several field laboratories of the division. Because of the differences in season, honey plants and other factors, certain beekeeping problems can be studied at one laboratory to better advantage than at others. Some of the recent trends in apicultural practice and research were discussed.

The remainder of the program included the following papers: Sex determination of honey bees, W. J. Nolan. Some cultural characteristics of *Bacillus larvae*, C. E. Burnside.

Discussion followed by McIndoo, Snodgrass, Cushman and Back, and Dr. Hambleton gave an interesting survey of the use in medical practice of the natural stinging of honey bees, particularly as related to arthritis.

Adjournment at 10 P. M.

ASHLEY B. GURNEY,
Recording Secretary.

BOOK NOTICE.

THE WORKS OF HENRY DAVID THOREAU, Selected and edited by Henry Seidel Canby, 8 vo., cloth, 848 pp., 11 reproductions of photographs by Henry B. Kane. Boston, Houghton Mifflin Co., 1937, $5.00.

In event that some small portion of the entomological fraternity may not readily recognize a fellow entomologist in Henry David Thoreau (1817–1862), the American naturalist, writer, educator, lecturer, ethnologist, poet and philosopher, let it be remembered that an actual tabulation published some years ago by one of his admirers (Jour. N. Y. Ent. Soc. 35 : 1–21, Mch., 1927) after an exhaustive study of the 20 volume Walden edition of his published writings revealed that he had given consideration therein to a total of 2,512 insects, and had shown abundant evidence not only that he had studied them long and faithfully, but that his discussions of them proved him to be a prose writer of the highest distinction. Thoreau has been over seventy-five years in his grave and with the passing of the years his reputation as a writer and as a naturalist has been steadily growing. Comparatively unknown and unappreciated during his lifetime, it has been his subsequent destiny to attain world wide and steadily growing fame. There is, as Canby has pointed out, a "growing belief that he belongs to the small group of really great Americans." One excellent criterion by which to measure something of the growth and permanence of this attitude toward him is to examine into and evaluate the output of the various editions of his published works. The very considerable total of all these over the many

decades take on an added and a touching significance to those to have learned to love his writings and to revere his memory as one of the world's great souls. And now there has been issued still another edition, this time under the editorship of the well known literary critic Henry Seidel Canby, in which edition all the more important—the outstanding portions of Thoreau's writings, including parts of his "Journal" now out of print, are made available for the first time in a single volume. A survey of this book will show that its arrangement is designed for easy reading and for ready reference. The introduction and the short biography by the editor are followed by selections of excerpts from the "Journal," and a slightly abridged text of the "Week on the Concord and Merrimack Rivers," first published in 1849. This is followed by "Walden," printed entire from the first edition of 1854, a selection of his better known "Poems," and travel chapters from his posthumous books the "Maine Woods" and "Cape Cod." Those who have enjoyed reading his nature essays may find included most of the old friends such as "Natural history of Massachusetts," "Walking," "Autumnal tints," "Wild Apples," "Succession of forest trees," and the like. Also, while not of entomological interest, there are given likewise a number of other well known essays as "Life without principle," the well-known lectures on "John Brown," "Civil disobedience," and on other issues of his day. The editor has very fittingly added at the end of the volume a well-selected bibliography of biographical, critical and other material. Obviously, a writer who dies at forty-five leaves behind him much unfinished literary work, and those who have taken the trouble to trace out Thoreau's literary methods, in sufficient detail to discern the extreme care used by him in rewriting and recasting original "Journal" material, again and again, until satisfactory, will be quick to apprehend that several more books could even yet be quarried from that voluminous "Journal." And this is particularly true of his entomological material since much of it yet remains to be placed in final order. Notes from Thoreau's "Journal" are seldom cast in final literary form. Many of them stand in need of shaping and polishing, but they are none the less interesting for that and they are seldom mere records of fact. However, in the edition under consideration much of the best of his entomological work has been retained, and it is with pleasure that one can read again such well-known favorites as the "Battle of the Ants," and others. However, it better suited his genius to trace some analogy between the flying insect and his own thoughts than to make a scientific study of it. Thoreau was seldom dull even in mere records of commonplace facts, and the reader of this book, though he may be well acquainted with the author's picturesque style, can hardly fail to be impressed anew with his power to convey a vivid and interesting picture in a few words.

The book on the whole is a valuable addition to Thoreauana, and its reading and re-reading is commended. Query: Is there any living entomologist anywhere to-day whose work will be sufficiently valuable and whose fame will be sufficiently lasting that his writings will thus be republished seventy-five years after his death? —J. s. w.

Actual date of publication, April 30, 1938

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DESCRIPTIONS OF NEW NORTH AMERICAN TRICHOPTERA.

By HERBERT H. ROSS,

Illinois State Natural History Survey, Urbana, Ill.

Collections of caddis flies examined recently have included specimens of hitherto undescribed forms which show some new characters for the group. The following descriptions include the more interesting of these. I wish to express my gratitude to Dr. C. O. Mohr, Illinois State Natural History Survey, for assistance with the drawings. Holotypes are deposited in the Illinois Natural History Survey collection.

Rhyacophila gemona, new species.

Male.—Length 17 mm. Head, body, antennae, and mouth parts almost black, legs dark brown at base, grading to tawny at apex; wings without an obvious pattern, conspicuously mottled with medium brown and light gray. General structure typical for genus. Genitalia, fig. 1, most closely resembling those of *acropedes* Banks, differing in the dorso-ventrally compressed ninth segment and the curious tenth tergite. Ninth segment wide, collar-like and twice as wide as deep. Tenth tergite fitting into a concavity on the ninth, its base with a pair of dorsal projections forming a heart-shaped basal cavity, the apical portion produced into a wide, bifid process. Claspers long; the basal segment seen from lateral view slightly longer than the apical, with a constriction near middle, but seen from ventral view with a foot-like base at right angles to lateral portion; apical segment sinuate, its apex incurved and produced into a narrow lobe whose inner margin is beset with a cluster of black setae. Aedeagus composed of three parts: a sclerotized, cap-shaped base from the dorsum of which protrudes an elongate sclerotized tube somewhat heart-shaped at the base but rapidly tapering to a narrow tube; from the ventral part of the cap-like plate extend a pair of extensile membranous appendages bearing a "claw" of dense, sharp setae at apex.

Holotype, male.—Razorhone Creek, Mt. Baker, Wash., July 21, 1936, H. H. Ross.

Rhyacophila norcuta, new species.

Male.—Length 11 mm. Head and body black; antennae, base of legs, and wings dark brown; apical portion of legs shading to tawny, front wings with scattered patches of light hair. General structure typical for genus. Genitalia, fig. 2, most closely resembling those of *rotunda* Banks, differing in the produced mesal portion of the tenth tergite, infolded dorso-mesal lobe of apical segment

of clasper and other characters. Ninth segment angulate where indented to receive clasper. Tenth tergite longer than wide, dorsal portion prolonged into a semi-truncate mesal lobe. Claspers deep; basal segment with apico-ventral corner produced considerably ventrad and joining the body of segment with a deep crease; apical segment much deeper than long, apical margin incised, ventral lobe produced, and lateral face with a very pronounced ridge extending from the base into the ventral lobe; mesal side of segment with a large area folded over, entire segment somewhat boot-shaped. Aedeagus with a central sclerotized flap, produced at apex into a thin point; from the base arise a pair of extensile membranous arms, each with a semi-sclerotized flap at apex covered with a thin brush of stout bristles.

Holotype, male.—Ilwaco, Wash., May 26, 1918, A. Spuler.

Rhyacophila pellisa, new species.

Male.—Length 8 mm. Body dark brown; antennae slightly lighter; legs luteous; wings uniformly infuscate with brown, with only a few inconspicuous lighter areas around apex. General structure typical for genus. Genitalia, fig. 3, resembling most closely those of *atrata* Banks and *valuma* Milne, differing in shape of tenth tergite and aedeagus. Tenth tergite incised on meson to form a V-shaped sclerite. Claspers with basal segment long and parallel-sided, approximately three times as long as wide; apical segment rhombic, its apical margin abruptly and deeply incised at dorsum so that apex of dorsal margin forms a short, overhanging hook. Aedeagus with a dorsal, sclerotized tube and a ventral spatula which has its base membranous and apex covered with a cluster of long, spiculate hair confined to dorsal and lateral surfaces; this apical brush is fusiform from all angles, not clavate as in *valuma*.

Female.—Similar in size, color, and general structure to male. Apex of abdomen drawn out into a narrow tube in which all the segments are cylindrical and unmodified.

Holotype, male, and *allotype, female.*—Cascade Lodge, Rocky Mountain National Park, Colo., Aug. 2, 1931, H. C. Severin. *Paratypes.*—Same data, 3 ♂, 7 ♀.

Dolophilus strotus, new species.

Male.—Length 4.3 mm. Color uniform yellowish-brown with eyes black and pubescence ranging from tawny to dark brown. General structure typical for genus, R_{2+3} undivided, abdominal sternites without ornamentation. Lack of tubercles or flaps on seventh and eighth sternites separates this species from *shawnee* Ross, its closest ally. Male genitalia as in fig. 6. Ninth segment widest in middle, tenth tergite and cerci set into a notch in its dorsum. Tenth tergite somewhat triangular, its apex narrowly truncate, its base indistinctly separated from either ninth tergite or cerci. Cerci finger-like, slightly shorter than tenth tergite, with a cluster of fine setae at apex. Claspers with basal segment narrowed towards apex, shorter and stockier than apical segment, which is slightly narrowed just beyond middle and expanded into a slightly spatulate apex. The inner face of this spatulate apex bears a brush of short, stout, black setae.

Holotype, male.—Page, Okla., June 23, 1937, Standish-Kaiser.

Parapsyche almota, new species.

Male.—Length 13 mm. Head and body mottled with dark and light brown, antennae and legs tawny, wings purplish with abundant pale areas scattered over the entire front wing. General structure typical for genus. Genitalia, fig. 5, resembling very closely those of *apicalis* (Banks), differing in the dorsal production of the ninth tergite into a pair of high and declivous humps, in addition to differences in other parts of the genitalia. Tenth tergite divided into a pair of cylindrical, curved arms which almost meet apically, the base of each with a small patch of long setae. Claspers short and one-segmented, with a thumb-like process projecting from mesal side of ventral margin; clasper clothed with abundant setae but mesal process beset only with minute pore-like structures. Aedeagus with a wide base and a constricted middle portion which is slightly expanded at apex; extreme apex with a large sclerotized hook curved ventrad.

Female.—Length 14 mm. Color and general structure as in male. Eighth tergite regularly collar-like, without brushes of setae. Eighth sternite divided into two plates separated along the meson for their entire length and with the apico-mesal region evenly rounded and bearing an even, sparse row of setae from the apico-lateral corner to the middle of the mesal margin. Remainder of the genitalia similar in essential respects to *Hydropsyche.*

Holotype, male.—Almota, Wash. *Allotype, female.*—Vancouver, B. C., July 20, 1936, along Seymour Cr., H. H. Ross.

Parapsyche cardis, new species.

Male.—Length 14 mm. Body and wings mottled with light and dark shades of brown typical of other members of the genus. General structure typical for genus. Genitalia, fig. 4, resembling most closely those of *elsis* Milne, differing in the heart-shaped tenth tergite and shorter claspers. Ninth segment produced into a dorsal hump. Tenth tergite short and wide, the apex turned ventrad, the dorsal view heart-shaped, tapering to a rounded point. Claspers short and very slightly sinuate, the dorsal margin rounding into the apical, the apico-ventral corner sharply angulate, with no vestige of a suture separating off an apical segment. Aedeagus with semicircular general outline, the base largest, the apex bearing a dorsal, thumb-like projection: from the apex protrudes a series of membranous folds containing internal sclerotized supports.

Holotype, male. Smokemont, N. C., June 14, 1935, H. H. Ross.

HOMOPLECTRA, new genus.

Characteristics.—Wing venation, spur count, and structure of mouth parts typical for the family Hydropsychidae. It is most closely related to *Diplectrona* Banks but differs in the coalesced condition of Sc_2 and R_1 in both wings. Antennae relatively short and robust. Posterior portion of dorsum of head with a high, raised "V" composed of a pair of sharp, short ridges diverging anteriorly, not quite meeting posteriorly. All wings with Sc_2 joining R_1 at base of stigmal region, the two immediately separating and diverging again.

Genotype.—*Homoplectra alseae* n. sp. (original designation).

The species *Diplectrona nigripennis* Banks belongs in this genus.

Homoplectra alseae, new species.

Male.—Length 8.5 mm. Head, body, and base of legs black; antennae, apex of femora, tibiae, and tarsi golden yellow; wings almost black. General structure as described for genus. Genitalia similar in general pattern to those of *nigripennis* (Banks), but differing in the more complicated structure of the aedeagus, fig. 7. Tenth tergite with a pair of dorsal horns. Claspers long and slender, with an indistinct suture separating off a button-like apical segment. Aedeagus consisting of a large bulb-like internal base from which arise the following structures, numbered as in fig. 7: (1) a stout, curved dorsal prong subdivided at apex, not projecting beyond body cavity; (2) a pair of sclerotized filaments arising just beneath; (3) a pair of sclerotized processes with a bulbous, sinuate base and narrow, tapering apex; (4) the rod-like apex of the aedeagus proper; and (5) a long, slender, sclerotized process below this whose apex is split into a pair of ribbon-like plates.

Holotype, male.—Alsea Mountain, Benton County, Ore., May 3, 1936, H. A. Scullen.

Hydropsyche amblis, new species.

Male.—Length 10.5 mm. Head and thorax black, abdomen and appendages tawny, antennae with dark, dorsal V-marks on seven basal segments of flagellum, wings dark brown with very little pattern. General structure typical for *alternans* group, differing from *tana* Ross, its closest relative, in the long snout of the aedeagus and sessile, dorso-lateral spur of aedeagus. Genitalia, fig. 9, with tenth tergite produced into a sharp dorso-mesal hump and its apex divided into a pair of deep, thin, lateral processes which form a semicircle when seen from dorsal view. Claspers with apical segment short, its apex produced into a slight point. Aedeagus with base wide, forming a right angle with remainder; dorso-lateral process represented by a sessile spur which curves outward; apex produced into a thumb-like process bearing two pairs of setal pouches, the anterior pair opening through the apex, the posterior pair through the side-wall.

Holotype, male.—Corvallis, Ore., June 6, 1935, G. Ferguson.

Hydropsyche protis, new species.

Male.—Length 8 mm. Head and body dark brown, appendages light brown; wings brown, apical portion with a row of light spots running from stigma to anal angle. General structure typical of *alternans* group, differing from *amblis* in the aedeagus, which does not extend beyond dorso-mesal plates. Genitalia, fig. 8, with tenth tergite hump-like, the hump subdivided into a pair of hairy, low, lateral lobes and a sharp, slightly higher, unclothed mesal lobe; apico-lateral processes finger-like and of moderate length. Claspers with apical segment short, upper margin concave, apex slightly pointed. Aedeagus with the "bend" obtuse and the base large; dorso-lateral process represented by a sessile, out-turned spur; apex short, not extending beyond dorso-mesal plates and containing a double pouch of long, upturned setae.

Female.—Robust and slightly longer than male, otherwise similar in size, color, and general structure. Plates of eighth sternite differing from other members of the *alternans* group in that they are not produced into a high lobe

but are almost identical with those of *H. cuanis* Ross, having the meso-apical corner almost quadrate.

Holotype, *male*, and *allotype*, *female*.—Trout Creek, Utah, July 25, 1935, H. B. Stafford.

Hydropsyche orris, new name.

Hydropsyche cornuta Ross, Ill. St. Natural History Survey Bull., 21 (4) : p. 141, March, 1938. Preoccupied by *H. cornuta* Martynov, 1909.

Mr. Mosely has kindly drawn my attention to the prior use of Martynov's name.

Limnephilus aretto, new species.

Male.—Length 13 mm. Color brown, spines on legs black, and wings flecked with lighter and darker brown spots. General structure, including chaetotaxy of head, typical of subgenus *Anabolina*. Front basitarsus short and stocky, only half length of succeeding segment. Eighth tergite with a small, meso-apical projection covered with a brush of short, black setae.

Male genitalia, fig. 11, most closely resembling those of *occidentalis* Banks, but markedly different in the short, stocky, tenth tergite. Ninth segment reduced to a narrow collar dorsally, the ventral portion enlarged and somewhat bulbous. Plates of tenth tergite with a wide base and a short mesal process which is slightly recurved at the apex. Cerci without teeth or projections on mesal surface. Claspers short, stocky and truncate, and only indistinctly separated from ninth sternite. Aedeagus with central portion simple and with lateral arms as in fig. 11A, the apex produced into a long point with a stout spur at its base.

Holotype, *male*.—Pullman, Wash., C. V. Piper.

Stenophylax indiana, new species.

Male.—Length 17 mm. Body and appendages faun colored, the wings with a small dark spot in base of cell R_4 and around M just before it branches. General characteristics typical for subgenus, the spur count 1–2–2, the leg spines black.

Genitalia, fig. 10, most closely approaching *subfaciatus* (Say), differing most conspicuously in the very stocky aedeagus. Eighth tergite with the apico-mesal portion convex and bearing a pair of sparse brushes of small, dark setae; there is no concavity between the two brushes but a slight one laterad of each. Tenth tergite short, each half divided into a short, mesal point and a small, lateral hump. Cerci large, extending a considerable distance beyond apex of tenth tergite. Claspers held at right angles to longitudinal axis; base pad-like with abundant long setae, apex produced into a concave sclerotized plate whose mesal side is produced into a long, sharp point. Aedeagus short and stocky, apical portion extremely constricted just beyond base, apex narrowed to form a slightly constricted tube; lateral processes with base enlarged and vasiform, apical portion consisting of a stout spine sharply upturned at end.

Female.—Length 19 mm. Color and general structure as for male. No satisfactory characters have yet been found to distinguish it from females of *subfaciatus*.

Holotype, male.—Rogers, Ind., October 7, 1937, Ross & Burks. *Allotype, female.*—Athens, Ohio, September 23, 1933, W. C. Stehr. *Paratypes.*—Same data as allotype: Sept. 23, 1933, 1 ♀; September 15, 1933, 1 ♂; September 25, 1933, 1 ♂; September 30, 1931, 1 ♂.

Micrasema bactro, new species.

Male.—Length 6 mm. Color black the appendages shading to brownish General structure typical for genus. Male genitalia, fig. 12, indicating a similarity to the *rusticum* group, differing markedly, however, in the sixth, seventh, and eighth tergites, which are cut away dorsally so that the two sides are connected only by a narrow sclerotized bridge, fig. 12A. Cerci closely appressed at base, and their bases fused on the meson. Tenth tergite wide at base, narrowing to a rounded apex, and bearing dorsally a single wart with one or two scattered setae. Claspers clavate, the upper margin subdivided into a pair of setiferous, thumb-like processes, the apex broad and almost truncate, wider than base; the inner surface of the whole strongly concave.

Holotype, male.—Strawberry Camp, Grant County, Ore., July 17, 1936, 5700 ft. elevation, R. E. Reider.

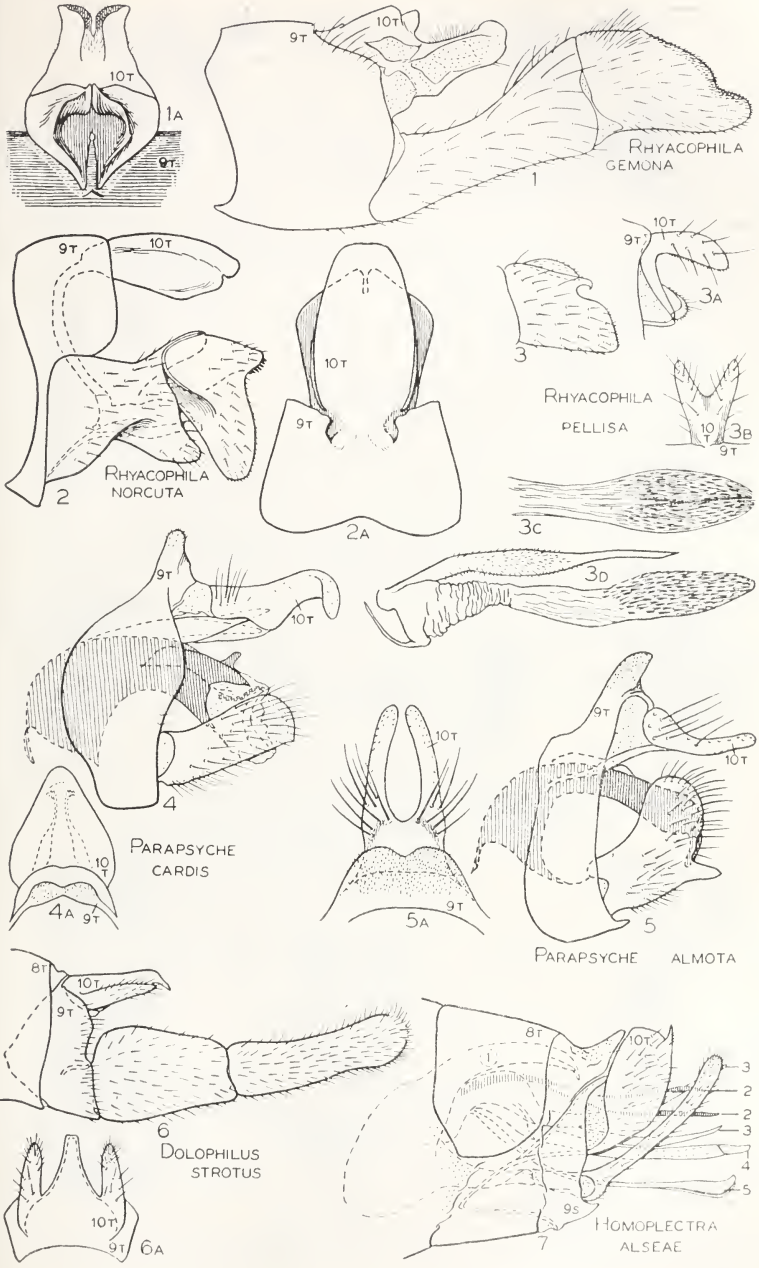
Explanation of Plates 12 and 13.

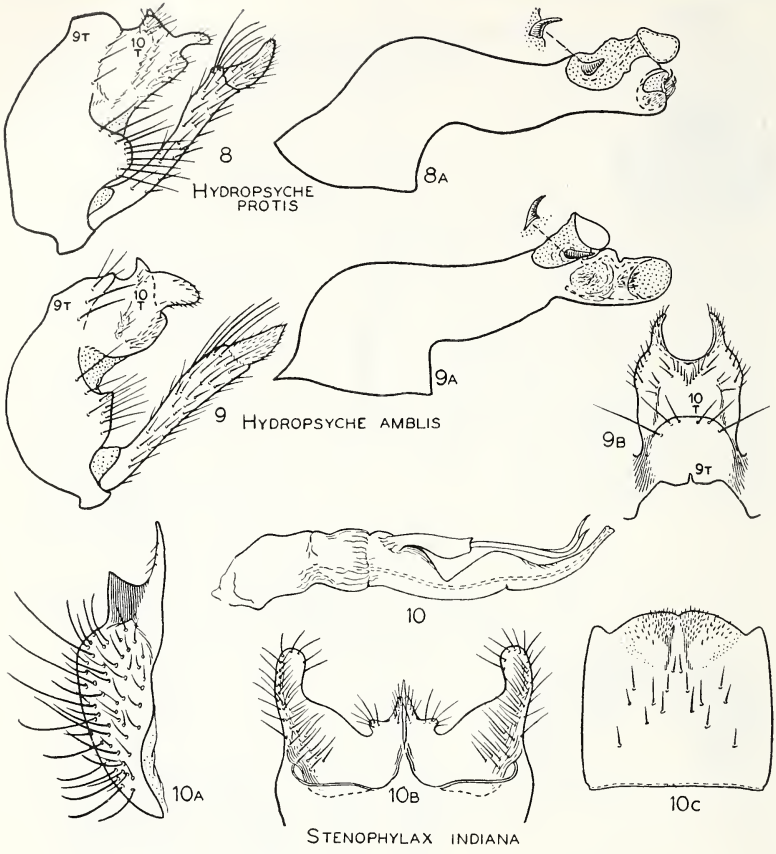
Male genitalia of Trichoptera.

Fig. 1. *Rhyacophila gemona;* 1A, tenth tergite, dorsal view.
Fig. 2. *Rhyacophila norcuta;* 2A, ninth and tenth tergites, dorsal view.
Fig. 3. *Rhyacophila pellisa,* apical segment of clasper; 3A, tenth tergite, lateral view; 3B, tenth tergite, dorsal view; 3C, ventral lobe of aedeagus, dorsal view; 3D, aedeagus, lateral view.
Fig. 4. *Parapsyche cardis;* 4A, tenth tergite, dorsal view.
Fig. 5. *Parapsyche almota;* 5A, tenth tergite, dorsal view.
Fig. 6. *Dolophilus strutus;* 6A, ninth and tenth tergites, dorsal view.
Fig. 7. *Homoplectra alseae.*
Fig. 8. *Hydropsyche protis;* 8A, aedeagus.
Fig. 9. *Hydropsyche amblis;* 9A, aedeagus; 9B, tenth tergite, dorsal view.
Fig. 10. *Stenophylax indiana,* aedeagus; 10A, clasper, caudal view; 10 B, ninth and tenth tergites, dorsal view; 10C, eighth tergite, dorsal view.
Fig. 11. *Limnephilus aretto;* 11A, aedeagus.
Fig. 12. *Micrasema bactro;* 12A, apex of abdomen, dorsal view.

Abbreviations.

6T, 7T. . .10T—Sixth to tenth tergites, respectively.
9s—Ninth sternite.


10T
1A
9T
9T
10T
1
RHYACOPHILA
GEMONA
9T
10T
2
RHYACOPHILA
NORCUTA
10T
9T
2A
9T
10T
3A
3
RHYACOPHILA
PELLISA
10T
3B
9T
3C
3D
9T
10T
4
PARAPSYCHE
CARDIS
10T
4A
9T
10T
9T
5A
9T
10T
5
PARAPSYCHE ALMOTA
8T
10T
9T
6
DOLOPHILUS
STROTUS
10T
9T
6A
8T
10T
3
2
2
3
1
4
5
9S
7
HOMOPLECTRA
ALSEAE


9T
10T
8
HYDROPSYCHE PROTIS
8A
9T
10T
9
HYDROPSYCHE AMBLIS
9A
9B
10T
9T
10
10A
10B
10C
STENOPHYLAX INDIANA
9T
10T
11
LIMNEPHILUS ARETTO
11A
12
MICRASEMA BACTRO
12A
8T
7T
6T

TWO NEW GENERA OF MYRMELEONIDAE.

By Nathan Banks.

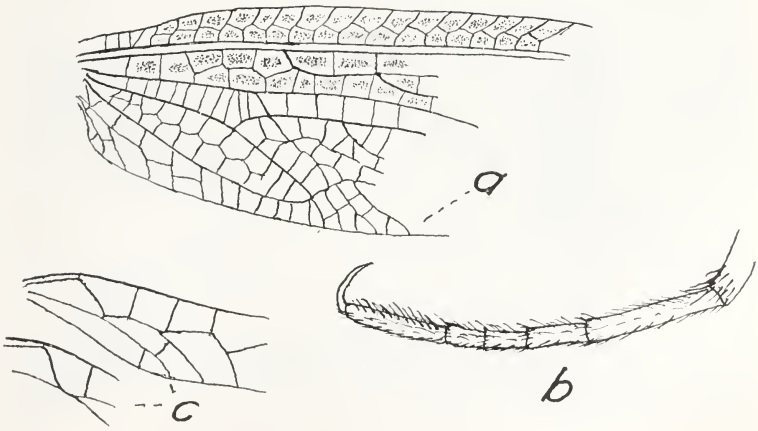
Among the ant-lion flies of the National Museum collection I have found two new genera. One fine and large species from South America is somewhat like the rare *Ripalda insignis* Rbr., but differs at once in the strongly sinuate hind margin of the front wings.

The other from Africa, from which such a great number of genera have been made in recent years, is no less striking than the Neotropical form; it has two definite characters, unusual in African species, no tibial spurs, and a double series of costal cells.

CAPOPHANES, gen. nov.

Belonging to the Macronemurini; no tibial spurs; the costal area of front wings with two series of cells from near the base to or beyond the middle. One cross-vein in hind wing before the radial sector, latter arising a little before the cubital fork; in fore wing several cross-veins before radial sector, latter arising plainly beyond cubital fork; several of the cross-veins before radial sector connected, and many of those in the area above the first anal vein. The second anal usually connected to third anal for a short distance, third anal forked.

Wings rather short and moderately broad, not broadened toward the tips, which are not acute; no distinct banksian lines; angle of cubitus and cubital fork, moderately wide. Legs not very stout, a little stouter than in *Gymnoleon;* tarsi long, first joint longer than fifth, second somewhat lengthened. Abdomen shorter than hind wings.



Capophanes conspersa; a, part of fore wing; *b*, hind tarsus; *c*, anal veins of fore-wing of two specimens.

Of the African genera without spurs *Banksius* belongs to the Dendroleonini (a small *Cymothales*), *Obus* belongs to the Gamini, *Gibrella* and *Gymnoleon* to the Macronemurini, but none of these genera have a two-celled costal area.

Capophanes conspersa, sp. nov.

Face pale; a dark interantennal mark, reaching below as a band across, and above to the front of the vertex, back of vertex also dark, thus leaving but one pale spot each side on vertex; palpi pale, last joint enlarged and dark. Pronotum almost as long as broad, sides almost parallel, with a broad dark median stripe, faintly divided with gray, a dark lateral stripe, and some dark dots in the pale pink area between; hair above short and black; long, curved white hairs on sides. Mesonotum dark, a pale spot each side on anterior lobe, two narrow pale stripes each side, and two similar stripes on the mesoscutellum, and its lateral corners pale; metanotum wholly dark; pleura dark, with pale areas, and much long white hair. Abdomen black, a little pale at tip, hair above very short and black, that below scarcely longer.

Legs yellowish brown, tarsi darker, with much white hair, very long on femora, bristles mostly black.

Forewings with nearly parallel sides for some distance; venation black and white, longitudinal veins streaked with dark, the radius almost wholly dark; cross-veins sometimes wholly dark, sometimes only dotted with dark; stigma pale, dark at base, and a faint cloud at end of the anal vein and one at rhegma; costal margin pale, outer margin dark, dotted with pale, hind margin dark; almost every cell contains a small dark cloud or umbra.

In the hind wing the subcosta is spotted with dark, the medius and first anal are almost wholly pale, the cubitus and radius almost wholly black, and the cubitus somewhat irregularly bordered with black, and a large dark cloud from the rhegma out, the outer veinlets being margined with dark.

In the fore wing the venation is very dense, and the cross-veins are often irregular or crooked, the broad costal area for half way or more divided by oblique connecting veinlets; a few post stigmal cross-veins; five cross-veins before radial sector, several of them connected, the first anal is curved a little downward and the area above it mostly two-celled; seven branches of radial sector, six branches of anal to margin, one or two cross-veins from anal to cubital fork.

Length of fore wing 26 mm., width 6 mm.

Length of hind wing 22 mm., width 5.5 mm.

From Mt. Brukkaros, S. W. Africa, 15 Sept., 28 Jan., and Tses, S. W. Africa, 20 May.

Type.—No. 52353, U. S. National Museum.

Paratypes in U. S. National Museum and Museum of Comparative Zoology.

ARAUCALEON, gen. nov.

Belongs to the Glenurini. In the fore wing the second anal vein runs up close to the first, connected to the first by an oblique vein, then bends down to unite with the third anal for a long distance, one of them being forked; basal cubital fork with one cross-vein. Fore wings broad near the tip, hind margin strongly bisinuate; radial sector arises a little before the cubital fork, about nine cross-veins before the radial sector; the anal vein before connecting to cubital fork bends down and then up; costal area mostly narrow, with many simple veinlets, in stigmal area the costal area is greatly broadened, and here there is a connecting series, near to the subcosta; apical field very densely veined; no trace of banksian lines.

Hind wings a little longer than front pair, strongly falcate at tip, much as in *Ripalda*, much narrowed at base; three cross-veins before radial sector; no definite fork to cubitus; first anal ending before radial sector.

Legs very slender, sense-hair at base of front femur not one-third of femur; spurs long, equal about two joints, a little curved near tip; basal tarsal joint about equal to fifth; pronotum much longer than broad; antennae long and but slightly clavate.

This striking form is related to *Ripalda insignis* Rbr. Navas has published some notes on the broken type; the legs, head, pronotum and shape of hind wings are much as in Araucaleon, but the hind margin of the front wings is sufficient to distinguish the latter genus; and there are doubtless minor details; the apical field is probably not nearly so densely veined, and Ramburs' figure does not show the swollen costal area near stigma.



Araucaleon inca, sp. nov.

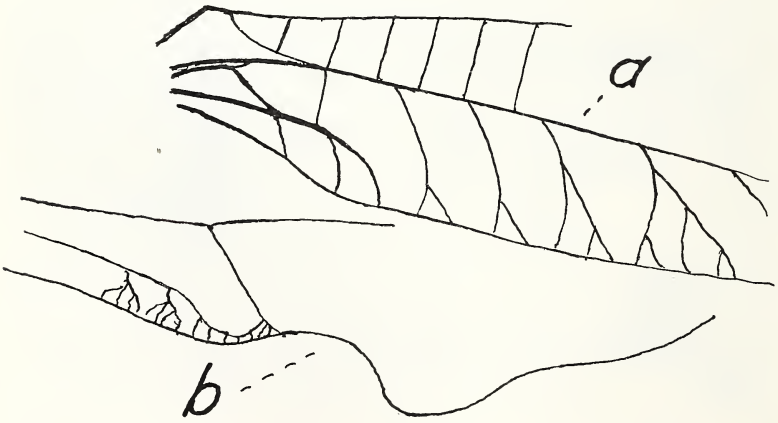
Head pale; a dark band above antennae, and a median spot below, vertex with an elongate dark spot each side near the middle, the anterior end of which reaches to the eye; palpi pale, antennae mostly dark brown, a broad pale band (about six joints) before the swollen tip; pronotum with a broad black band each side, leaving a narrow pale stripe between, and broad pale lateral stripes, hair above mostly long and black; rest of notum mostly black, anterior lobe of mesonotum with two pale spots, behind is a median pale stripe, and a lateral stripe each side above front wings; pleura mostly pale, a dark stripe just above coxae, latter partly dark; legs pale, but most of mid and hind femora dark, and base and tips of all tibiae dark, as well as the tips of the tarsal joints; front coxae with some long white hairs, elsewhere the hair and bristles are mostly black; abdomen brown above, pale beneath, with short black hair; the abdomen is much shorter than the hind wings.

Apical part of both wings dull milky white, elsewhere hyaline with brown spots and dots.

Fore wings with three irregular brown spots along the radius and subcosta, and some spots below the stigma, the enlarged costal area mostly brown, and a small white stigmal spot at its lower outer corner. There are four or five spots along branches of the anal vein, a brown streak obliquely up from end of cubital fork, and a large broad area along the outer margin to the whitish tip; throughout the middle area are various small brown spots; the veins (except in brown areas) are white.

In hind wings there is a large brown spot before the whitish tip, narrow above, but elongate on hind margin, a brown spot on hind margin at widest part of wing, another above it on cubitus and medius, and another above that on the radius, a few other faint small brown spots; veins mostly white.

In fore wings there are one or two cross-veins before radial sector connected,



Araucaleon inca; hind border of fore wing; *a*, near base; *b*, near middle.

and several between cubitus and anal; about ten branches of radial sector; most of the branches of anal are forked one or more times; above the medius and out to the stigmal area nearly all the cells are much higher than long.

In hind wings nine branches of radial sector, the anal does not reach out as far as the origin of the radial sector, and there are ten or twelve short simple branches of cubitus before there begins the series of connecting veinlets; none of these branches looks like a cubital fork.

Length of fore wing 40 mm., width 11 mm.

Length of hind wing 44 mm., width 8 mm.

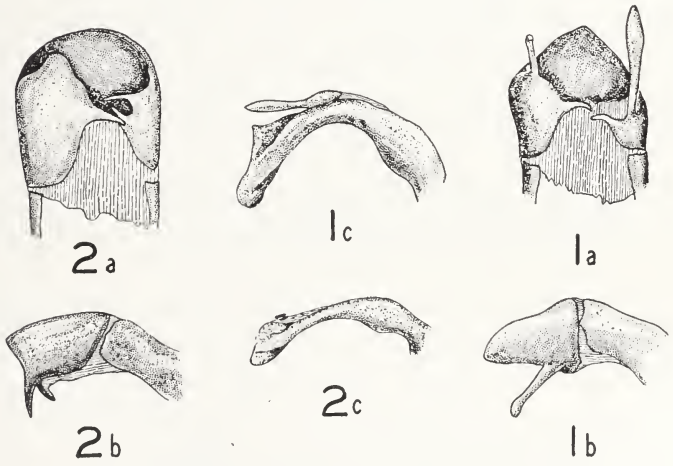
From Huachi, Bolivia, Sept. 1925.

Type.—No. 52694, U. S. National Museum.

A NEW PHYLLOPHAGA FROM NEVADA (COLEOPTERA: SCARABAEIDAE).

By Lawrence W. Saylor,
Bureau of Biological Survey, U. S. Department of Agriculture.

The following new species comes from an interesting region of the West, and has been awaiting description for some time.



Explanation of Text Figures.

Figure 1. *Phyllophaga sociatus* (Horn). Fig. 2. *Phyllophaga stohleri* Saylor.

a. Ventral view of male genitalia.

b. Side view of idem.

c. Side view of aedeagus.

Phyllophaga stohleri Saylor, new species

Male.—Rufous to rufocastaneous above, head and thorax strongly shining, elytra and part of the pygidium strongly pruinose. Head with front very rugosely and coarsely, contiguously punctured, with short erect yellowish hairs; clypeal suture subarcuate, nearly subtruncate at middle, not impressed; clypeus short, very broad, coarsely densely shallowly punctured, apex a very little reflexed and center of apex slightly, shallowly emarginate, angles broadly rounded. Antennae 9-segmented, club ovate and slightly shorter than funicle. Thorax with sides very coarsely crenate in front of the lateral dilation and finely crenulate behind the latter; hind angles evident but very obtuse, front angles sharp but obtuse, basal and front margins entire and thickened, especially the latter; disc glabrous but all margins with very long, dense yellowish hair, that of the lateral margins the longest; disc coarsely punctured, those at center of disc separated by one to two times their diameters, denser at sides and base, much denser along frontal margin, and less dense each side of median discal area. Elytra without obvious striae except sutural and these last widest at middle, noticeably tapering towards each end, and entirely obsolescent just before apex of elytra; surface of disc finely sparsely punctured, glabrous, side margins of elytra with long fine hairs. Pygidium pruinose in basal two-thirds, apical third shining; disc finely, very densely punctured, with dense short erect hair. Abdomen polished at middle, very finely sparsely punctured; fifth segment at middle densely finely punctured, declivious just before apical margin, with a few short erect hairs; sixth segment nearly as long as fifth, greatly transversely flattened, with sparse short, erect hair. Front tibiae tridentate, tarsi with small sharp tooth at inner apex of segments one to three. Hind tarsi about as long as their tibiae. All tarsal claws with a small acute tooth just above the middle. Hind femora very densely finely punctured with dense, erect long hair. Meso- and metasternum with dense, long, yellowish-white Hair. Hind spurs free.

Female.—Exactly similar to male except: the antennal club is a little shorter, and the abdomen is slightly convex, polished, with the fifth and sixth segments nearly on the same plane, the fifth segment being one-third longer than the sixth. Length 12.5 to 14.5 mm. Width 6.5 to 8.0 mm.

The *Holotype* male and *Allotype* female, also one *Paratype* male, are from the White Rock Springs, Nye County, Nevada, collected in May, 1931, by Dr. R. Stohler, who presented the specimens to the author. The holotype and allotype will be deposited in the collections of the U. S. National Museum, while the male paratype remains in the author's collection.

The present new species is closely related only to *Phyllophaga sociatus* (Horn) and the following key, as well as the very different male genitalia, will assist in separating the two species:

Pygidium of both sexes usually in great part pruinose and with the punctures very close together and almost touching, the hair very dense, short and erect; sutural striae of elytra widest at middle, noticeably narrower towards base and apices of elytra ..... *stohleri*

Pygidium of both sexes usually without pruinosity, the punctures commonly separated by 2 to 3 times their diameters, the sparse hair much finer than in above species and subprocumbent; sutural striae of elytra nearly the same width throughout, except immediately adjacent to the scutellum ..... *sociatus*

P. sociatus has heretofore been included in *Listrochelus* by most authors, but during the studies of Dr. E. A. Chapin and the author in a forthcoming revision of the subgenus *Listrochelus*, we have found it necessary to remove this species from the latter. The specimens of *P. sociatus* used by the author for comparison herein had been compared with the type by Dr. Chapin in 1934.

MINUTES OF THE 491ST REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 491st meeting of the Society was held at 8 P. M., Thursday, April 7, 1938, in Room 43 of the National Museum. Vice-President Snodgrass presided and 32 members and 9 visitors were present. The minutes of the previous meeting were read and approved.

The following people, whose applications had been approved by the Executive Committee, were recommended by F. W. Poos for membership in the Society and unanimously elected:

Floyd Andre, Division of Insect Identification, Bureau of Entomology and Plant Quarantine, Washington, D. C.

W. V. King, Bureau of Entomology and Plant Quarantine, Orlando, Florida.

H. H. Stage, Division of Insects Affecting Man and Animals, Bureau of Entomology and Plant Quarantine, Portland, Oregon.

H. E. Ewing called attention to the recent interest in the speed of insects during flight and mentioned some important literature containing pertinent examples of insects whose speed had been recorded by scientific methods.

E. N. Cory presented a note concerning a reference discovered in some historical entomological files suggesting the use of poisonous gas in capital punishment.

The regular program was in the form of a symposium on cotton insects. The first talk was by R. W. Harned, entitled "Work of the Division of Cotton Insect Investigation."

Dr. Harned discussed briefly the organization and work of the Division of Cotton Insect Investigations. There are four projects: boll weevil, pink bollworm, thurberia weevil, and miscellaneous cotton insect investigations. The latter includes the bollworm, cotton leaf worm, cotton flea hopper, tarnished plant bug and other mirids; stink bugs, aphids, thrips and other insects injurious to cotton. The Division maintains headquarters at Washington and has eleven field stations in cooperation with the State Agricultural Experiment Stations at Florence, S. C.; Tifton, Ga.; Gainesville, Fla.; State College and Stoneville, Miss.; Tallulah, La.; College Station, Port Lavaca, and Presidio,

Texas; Tucson and Mesa, Arizona. The damage caused to cotton by pentatomids and mirids, especially in Arizona and Texas, was discussed and the recent experiments indicate that this damage may be reduced by dusting the cotton fields with mixtures of sulphur and calcium arsenate and sulphur and paris green.

Discussion followed by Muesebeck, Loftin, Wood, Poos, Becker and Fuller.

The second talk, "Cotton insect investigations in Puerto Rico," was presented by L. C. Fife.

The nature and extent of injury of the major pests of Sea Island cotton in Puerto Rico were discussed. These included the following species: Pink bollworm, cotton leafworm, plant bugs, scale insects, mealybugs, cotton aphis, thrips, leaf and snout-beetles, etc. The problems of controlling these pests were summarized as follows: Since the standard of living is generally low, farmers do not have money for the purchase of insecticides for the control of injurious insects. The ecological approach, therefore, seems most desirable, i. e., to determine the environmental conditions that make it possible for the pest to maintain a high population density from year to year. We then must try to alter the insect's environment in order to prevent it from becoming abundant. The methods indicated were as follows: Uniform seasons of cotton production, eradication of favorable alternate host plants, a uniform dead season of at least three months in duration, seed treatment, destruction of crop remnants immediately after the harvest, early varieties, and the elimination of companion cropping between cotton and other crops.

U. C. Loftin addressed the Society on "Pink Boll Worm investigations."

Mr. Loftin discussed the history of the distribution and rapid spread of the pink bollworm from its original home in southern Asia to all of the major cotton countries of the world. The pink bollworm is particularly adapted to spread through commerce because long cycle or resting stage larvae are formed within cotton seed which may remain quiescent for over two years and transform to adults when moisture conditions become favorable. Collections of pink bollworm moths on airplane traps at 3,000 feet elevation and on tanglefoot screens near the ground, the infestations in trap plantings of cotton isolated 25 to 65 miles from other infestations in four of the five years, the direction of the wind, and the correlation between the total wind movement during September in the heavily infested Laguna section of Mexico and the increase in population in western Texas, all indicate that the moths fly or are involuntarily carried by the wind for long distances.

Busck, Cory, Becker, Harned and Ditman discussed Mr. Loftin's paper.

The last talk of the regular program was by B. D. Burks, entitled "Some chalcidoid parasites of cotton insects." Dr. Burks stated that with the exception of the hemipterous pests, all cotton insects are attacked by some species of chalcidoid parasites. None of these chalcidoids is, however, the most important parasite of any given cotton pest. Occasionally, in restricted areas, these parasites are sufficiently numerous to be important factors in controlling cotton insects, but due to the fact that many of them are or may be secondary parasites, it is necessary to distinguish the species carefully. Brief comments were made by Gurney.

Mr. Cushman spoke informally of the early work on cotton insects conducted by the Bureau of Entomology and of many personal recollections of entomologists and other people associated with him in Texas during the period 1906–1909.

Upon invitation from Mr. Snodgrass, the Rev. Edward Guedet of Napa, Cal., spoke briefly of his work with the Lepidoptera and of his pleasant and profitable visit at the Museum for the purpose of identifying his collection.

J. V. Schaffner, Jr., of New Haven, was introduced to the Society and made a few remarks.

Adjournment at 10.00 P. M.

ASHLEY B. GURNEY,
Recording Secretary.

Actual date of publication, May 27, 1938.

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ENTOMOLOGICAL SOCIETY

OF WASHINGTON



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ORGANIZED MARCH 12, 1884.

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Annual dues for members are $3.00; initiation fee $1.00. Members are entitled to the Proceedings and any manuscript submitted by them is given precedence over any submitted by non-members.

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PROCEEDINGS OF THE

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VOL. 40 JUNE, 1938 No. 6

THE NORTH AMERICAN EMPOASCAN LEAFHOPPERS OF THE ASPERSA GROUP (HOMOPTERA-CICADELLIDAE).

By P. W. OMAN,
Division of Insect Identification,
and
NANCY H. WHEELER,
Division of Cereal and Forage Insect Investigations,
Bureau of Entomology and Plant Quarantine.

In the course of examination of a considerable amount of accumulated leafhopper material belonging to the genus *Empoasca*, there were found a large number of specimens superficially resembling *Empoasca aspersa* Gillette and Baker. Upon preparation and examination of the internal male genitalia of these specimens, 17 different species were segregated. Since but 4 species belonging to the aspersa group have been described from North America, 1 of these from the female sex only, and since further studies have shown that *E. aspersa* G. & B. has been commonly misidentified, the need for a critical study of the species involved in this complex is apparent.

The members of the *aspersa* group range from slightly less to slightly more than 3 millimeters in length, and have the crown bluntly rounded and relatively broad although not parallel margined. The color is greenish white to yellowish green, usually more or less mottled with fuscous, producing in most species a mosaic appearance. Although distinct from other members of the genus in color pattern and external characters, these species are, in most cases, as difficult to distinguish from one another as those of the *fabae* group, and the characters of the internal male genital structures must be relied upon for accurate determination.

The *aspersa* group belongs in the subgenus *Hebata* DeLong, and its relation to the typical members of that subgenus is indicated by *vastitatis*, n. sp., which is somewhat intermediate in character between *E. aspersa* and *E. nigra* Gillette and Baker, the type of *Hebata*.

The species treated in this paper are all from the western part of the United States, although some of these or related species probably occur in adjacent portions of Mexico and Canada.

In distribution the group appears to be limited to the Artemisia belt, and the constant association of the various species with species of *Artemisia* suggests that the plants of that genus are their normal hosts.

The drawings included in this paper all show approximately the same enlargement and were made on coordinate paper with the aid of a micrometer disk ruled in squares and placed in the ocular of a binocular microscope. Since the genital capsules of members of the group are somewhat membranous and consequently subject to considerable variation in shape, they have little taxonomic value and are illustrated in outline by broken lines. The more constant and taxonomically important internal structures are shown by solid lines in most cases. The length of the sternal apodemes is given in terms of the abdominal segments, which, when the abdomen has been treated with caustic potash, are usually relaxed and elongated beyond the normal condition, with the result that such measurements are only relative. The size and shape of the sternal apodemes are relatively constant, and, as indicated by Poos,[1] are often of considerable aid in separating species. Three illustrations of each species are presented, namely, a lateral view of the male genital capsule, a ventral view of the male genital capsule, and a ventral view of the sternal apodemes of the male. Since these drawings are arranged on the plates from left to right in the order mentioned, the plates need no explanation.

No satisfactory characters have been found for the separation of the females of this group with the exception of *vastitatis*, which may be distinguished by the lack of the fuscous mottling on the fore wings, and *medora* and *vermispina*, the females of which have a pair of rounded emarginations in the posterior margin of the seventh sternite. The following key to the males is purely artificial and is included only in order to emphasize the more important structures used for the separation of species in the group.

KEY TO THE SPECIES OF THE ASPERSA GROUP (MALES).

1. Fore wings without fuscous mottling. Sternal apodemes large and unpigmented ..... 1. *vastitatis*, n. sp.
   Fore wings mottled with fuscous. Sternal apodemes either small or pigmented 2
2 (1). Lateral process, in lateral view, abruptly narrowed from dorso-cephalic margin just before tip, and terminating in a slender, curved, fingerlike process ..... 2. *medora* DeL.
   Lateral process, in lateral view, not abruptly narrowed from dorso-cephalic margin 3

[1] Poos, F. W. Four new species of Empoasca (Homoptera : Cicadellidae). Ent. Soc. Wash. Proc. 35 : 174, 1933.

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1. **Empoasca vastitatis,** n. sp.

Somewhat intermediate in character between the *nigra* group and the *aspersa* group, but placed with the latter because of its larger size and general habitus. Distinguishable from other species of the *aspersa* group by the absence of smoky mottling on the fore wings. Length 3–3.25 mm.

External characters.—General form distinctly more robust than in *aspersa*, crown broad but slightly produced medially. Color uniformly greenish white with greenish-yellow mottling on head and pronotum; fore wing hyaline apically, veins obscure except in hyaline area. Posterior margin of seventh sternite of female produced and broadly rounded.

Male internal structures.—(Pl. 14.) Lateral process long and slender, with sides parallel to near pointed apex, distal portion slightly sinuate in both lateral and ventral views. Style long, relatively broad, with tip bent laterad. Dorsal spine broad basally, strongly curved first caudad, then ventrad and cephalad, broadly indented on central caudal margin and faintly serrate along caudo-ventral margin, with a pointed, fingerlike projection extending ventrad and mesad from cephalic margin. Aedeagus slender distally, portion for muscular attachment at nearly right angles to shaft. Sternal apodemes large and sack-like, rounded apically and reaching almost to base of fifth segment.

Holotype male, allotype female, and one male and five female paratypes from White Sands, N. Mex., June 7, 1933 (Oman). Type, U. S. National Museum No. 51619.

2. **Empoasca medora** DeLong.

Empoasca medora DeLong, Ohio Jour. Sci. 32(4) : 397, 1932.

A pale, mottled, relatively robust species with the lateral process terminating in a slender, crooked, fingerlike projection. Length 3 mm.

External characters.—General color pale greenish white, smoky markings on fore wings faint. Seventh sternite of female long, posterior margin with a narrow, rounded emargination on each side of a broad, shallowly notched median lobe.

Male internal structures.—(Pl. 14.) Lateral process stout, curved upward in lateral view, becoming stouter distally, abruptly narrowed and truncated from dorso-cephalic margin near tip, remainder slender, tapering, and slightly sinuate; sides in ventral view comparatively straight and nearly parallel margined, broader distally and terminating in a crooked, pointed projection. Dorsal spine stout, slightly curved cephalad and bluntly pointed. Aedeagus slender. Sternal apodemes fuscous, rounded apically and extending almost to base of fifth segment.

Originally described from five females from Medora, N. Dak. (Ball). The male of this species is here described and figured for the first time, the description and figures being based on a male from McCone County, Mont., July 27, 1927, E27–124 (no collector). Other specimens at hand are from Billings, Custer, Helena, and Sanders, Mont. (no collector); Lusk, north of Lusk, Pierre,

and Wall, S. Dak. (Oman); and Cross Mountain, Colo. (Knowlton). Type in the collection of E. D. Ball.

3. **Empoasca vermispina,** n. sp.

Superficially identical with *medora* but with a long, slender, sinuately curved dorsal spine. Length 3 mm.

External characters.—Head, pronotum, and scutellum pale greenish white, irregularly marked with pale greenish yellow; fuscous markings on fore wings faint, veins of fore wings greenish white and usually distinct. Seventh sternite of female like that of *medora* but with emarginations of posterior margin much broader and median lobe more produced and rounded.

Male internal structures.—(Pl. 14.) Lateral process curved upward in lateral view, enlarged just before apex; in ventral view with a distinct bulge on inner margin near apex, beyond this curved mesad. Style long and slender, with apex bent laterad. Dorsal spine long and sinuately curved, relatively broad basally but abruptly narrowed from cephalic margin, tip bluntly pointed. Aedeagus broad distally in lateral view. Sternal apodemes fuscous, comparatively long and slender, converging distally and extending to middle of fifth segment.

Holotype male, allotype female, and 4 male and 24 female paratypes from Macdoel, Calif., July 1, 1935 (Oman). Type, U. S. National Museum No. 51620. Four paratypes deposited in collection of the entomological laboratory, Arlington Experiment Farm, Arlington, Va.

4. **Empoasca aspersa** Gillette and Baker.

Empoasca aspersa Gillette and Baker, Colo. Agr. Expt. Sta. Bull. 31 : 107, 1895.

A pale, greenish white species with greenish yellow marks on the head and pronotum and the fore wings faintly mottled with fuscous. Dorsal spine somewhat boot-shaped in lateral view. Length 2.7–3 mm.

External characters.—Seventh sternite of female with posterior margin produced and shallowly notched medially and with a shallow, rounded emargination near each lateral angle.

Male internal structures.—(Pl. 14.) Lateral process in lateral view curved slightly dorsad, distinctly broader just basad of pointed apex, which is directed caudad; in ventral view with inner margin of apical third sinuate and broadly concave. Dorsal spine broad, terminating in a pointed toelike projection which is directed ventrad and cephalad, entire spine somewhat boot-shaped in outline. Aedeagus broad distally, shaft short and stout. Sternal apodemes broad, fuscous distally, and extending beyond base of fourth segment.

The original description of *aspersa* was based upon six females and two males from Colorado, and of this material apparently only four females and one male, now in the collection of the Colorado State College, are extant. These five specimens have been examined through the courtesy of Dr. M. T. James, and the male from Steamboat Springs, Colo., July 12, 1894 (Baker),

labeled "Colo. 1687,"[2] is designated lectotype. The identity of the female specimens is uncertain.

This is not the same species as that described and figured by DeLong[3] in 1931. The specimen in the National Museum which DeLong refers to as type is a female collected at Ft. Collins, Colo., in September, on *Chrysothamnus* (Baker), but is not one of the original series and therefore can not be the type.

In addition to the lectotype we have examined a long series of specimens from east of Laramie, Wyo., July 20, 1935 (Oman).

5. **Empoasca neaspersa,** n. sp.

Empoasca aspersa DeLong (nec Gillette and Baker, 1895), U. S. Dept. Agr. Tech. Bull. 231 : 34, 1931.

Resembling *aspersa* superficially, but with shorter dorsal spines and incised lateral processes. Length 2.9–3.2 mm.

External characters.—Head, pronotum, and scutellum greenish white mottled with pale greenish yellow. Fore wings with distinct fuscous mottling, veins pale greenish white and usually distinct. Seventh sternite of female with posterior margin slightly produced and faintly notched medially and next each lateral angle.

Male internal structures.—(Pl. 15.) Lateral process long, stout medially, distal portion sinuous and tapering to pointed apex; in lateral view with a narrow incision in caudo-ventral margin near middle. In the large series of specimens examined there was noted some variation in the shape of the lateral process, but the illustrations represent what seems to be the normal condition. Dorsal spine rather small, tapering from base to bluntly pointed tip. Aedeagus not so broad distally as in *aspersa*. Sternal apodemes relatively broad basally, broadly rounded and fuscous distally, extending to base of fifth segment.

Holotype male, allotype female, and 6 male and 22 female paratypes from Pasco, Wash., July 8, 1935 (Oman). There are also at hand numerous specimens from various localities in Arizona, California, Colorado, Montana, New Mexico, Oregon, South Dakota, Utah, and Washington. Type, U. S. National Museum No. 51621. Four paratypes deposited in collection of the entomological laboratory, Arlington Experiment Farm, Arlington, Va.

6. **Empoasca similis** DeLong and Davidson.

Empoasca similis DeLong and Davidson, Ohio Jour. Sci. 35(1) : 37, 1935.

Resembling *aspersa* in general appearance, but with the lateral process, in lateral view, tapering gradually from base to slender tip. Length 2.7–3 mm.

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[2] The specimen from Steamboat Springs, Colo., July 12 (Baker), is recorded by Gillette and Baker as being collected on *Artemisia tridentata*, but Dr. James informs us that according to the Colorado list of numbers, 1687 was "on Carex." Since the preceding number in the list, i. e. 1686, has "swept from *Artemisia tridentata*" as part of the collection data, it seems probable that this discrepancy was due to an error in copying the data.

[3] DeLong, Dwight M. A revision of the American species of Empoasca known to occur north of Mexico. U. S. Dept. Agr. Tech. Bull. 231 : 30 and 34, 1931.

External characters.—Pale greenish white with the fore wings and sometimes the pronotum also mottled with smoky fuscous. Seventh sternite of female with posterior margin produced and rounded.

Male internal structures.—(Pl. 15.) Lateral process, in lateral view, with distal third bent upward, tip pointed and slightly recurved; in ventral view tip slender and curved slightly mesad. Dorsal spine short. Aedeagus rather slender basally, distal portion relatively broad in lateral view. Sternal apodemes fuscous, broad, rounded distally and extending nearly to base of sixth segment.

Although the original description contains remarks concerning the female sex, the authors state that the species was described from five male specimens from Carson City, Nev. (Beamer). Specimens at hand are from Cajon Pass, Calif. (Oman) and Arimo, Idaho (Oman). Type in collection of the University of Kansas.

7. **Empoasca decora** DeLong and Davidson.

Empoasca decora DeLong and Davidson, Ohio Jour. Sci. 35(1) : 33, 1935.

A common and widely distributed species, resembling *neaspersa* in general appearance but without incised lateral processes. Length 2.5–3 mm.

External characters.—Somewhat variable in color; the head, pronotum, and scutellum usually pale greenish white mottled with sordid greenish yellow. Posterior margin of seventh sternite of female produced and broadly rounded.

Male internal structures.—(Pl. 15.) Lateral process tapering gradually from base to pointed tip, distal portion slightly recurved in both lateral and ventral views. Dorsal spine small and blunt. Aedeagus relatively slender, distal portion not so broad as that of *neaspersa*. Sternal apodemes broad, rounded distally, extending well beyond base of fourth segment, distal two-thirds usually fuscous.

The illustrations of *decora* which accompany this description were made after examining a great many specimens from various localities and represent what seems to be the typical condition. DeLong and Davidson described *decora* from specimens from Otero County, N. Mex. (Painter), Alpine, Calif. (Beamer), Cedar City, Utah (Beamer), and Carson City, Nev. (Beamer), the type being from the first-named locality. There are specimens at hand from a great many localities in California, Colorado, Idaho, Oregon, Texas, Utah, Washington, and Wyoming. Location of type not stated in the original description.

8. **Empoasca indenta,** n. sp.

Resembling *neaspersa* but with fewer and less definite markings on head and pronotum, and with a shallow dorsal emargination about the middle of the lateral process. Female unknown. Length 3 mm.

Male internal structures.—(Pl. 15.) Lateral process with a shallow, rounded emargination on the dorsal margin about the middle, posterior half bladelike in lateral view; in ventral view process stouter medially, with apex curved

mesad. Dorsal spine relatively stout and blunt, extending first ventrad, then curved cephalad and mesad. Aedeagus similar to that of *decora*. Sternal apodemes relatively small, bluntly rounded and converging apically, distal portion fuscous and extending to base of fourth segment.

Holotype male from Blue Beach, Utah, August 17, 1935, on *Artemisia tridentata* (Knowlton). Type, U. S. National Museum No. 51622.

9. **Empoasca calyxa**, n. sp.

Resembling *decora* but with lateral process, in ventral view, more slender and curved laterad distally. Female unknown. Length 2.8 mm.

External characters.—Head irregularly marked with orange or yellow, pronotum marked with sordid greenish yellow and frequently with a pair of small fuscous spots near anterior margin medially.

Male internal structures.—(Pl. 15.) Lateral process slightly constricted near middle in lateral view, curving slightly upward and outward, and faintly emarginate dorsally near pointed apex; in ventral view curved mesad about middle, with distal portion curved laterad and both outer and inner margins sinuous. Dorsal spine stout and blunt, curving ventrad and slightly cephalad and mesad. Aedeagus as in *decora*. Sternal apodemes comparatively small, distally fuscous and bluntly rounded, extending to base of fifth segment.

Holotype male from Wolcott, Colo., Aug. 24, 1935 (Knowlton). Paratype males as follows: One, Bray, Calif., June 30, 1935 (Oman); two, Durango, Colo. July 2, 1933 (Oman); one, Spur, Tex., June 7, 1929 (Fletcher); one, Fruitland, Utah, July 18, 1935 (Oman); one, 7 miles southeast of Laketown, Utah, July 5, 1935 (Knowlton); one, Virgin, Utah, July 18, 1936 (Knowlton); and one, St. George, Utah, June 6, 1935, light trap (Davis). Type, U. S. National Museum No. 51623. One paratype deposited in collection of the entomological labortory, Arlington Experiment Farm, Arlington, Va.

10. **Empoasca sinuata**, n. sp.

Resembling *calyxa* but with the markings on the head pale greenish yellow and the tip of the lateral process curving mesad rather than laterad. Female unknown. Length 2.9 mm.

Male internal structures.—(Pl. 16.) Lateral process, in lateral view, with margins nearly parallel, apex appearing blunt; in ventral view basal half broad, distal half with inner margin sinuous, apex sharply pointed and directed caudomesad. Dorsal spine broad basally, rather short, anterior margin sinuous, apex pointed and directed cephalo-mesad. Aedeagus simple and relatively slender. Sternal apodemes comparatively small, fuscous and bluntly rounded distally, extending to middle of third segment.

Holotype male from La Salle, Utah, June 18, 1933 (Knowlton). Type, U. S. National Museum No. 51624.

11. **Empoasca amblacantha**, n. sp.

Resembling *sinuata* in general appearance, but with the dorsal spine blunt and lateral process not sinuous on inner margin distally. Female unknown. Length 2.9 mm.

Male internal structures.—(Pl. 16.) Lateral process, in lateral view, curving upward and much more slender on distal third than basally; in ventral view long and relatively slender, margins nearly parallel, apex blunt. Dorsal spine broad and relatively short, directed ventrad and curved slightly cephalad and mesad, appearing bluntly pointed in lateral view. Aedeagus simple and relatively slender. Sternal apodemes fuscous and bluntly rounded distally, extending to base of fifth segment.

Holotype male and one male paratype from Bray, Calif., June 30, 1935 (Oman). Type, U. S. National Museum No. 51625.

12. **Empoasca pelecana,** n. sp.

A greenish white, distinctly mottled species, with the lateral process very broad distally in lateral view. Female unknown. Length 2.9 mm.

Male internal structures.—(Pl. 16.) Lateral process, in lateral view, extending first caudad, then obliquely dorso-caudad, with broad distal portion directed caudad, apex pointed; in ventral view the broad, flangelike, distal portion appearing much narrower, somewhat sinuous, and pointed. Dorsal spine broad and long, curving slightly cephalad distally. Aedeagus simple and relatively broad. Sternal apodemes large and sacklike, slightly fuscous, broadly rounded apically, and extending to base of fifth segment.

Holotype male and one male paratype from Kremmling, Colo., July 17, 1935 (Oman). Type, U. S. National Museum No. 51626.

13. **Empoasca varaspina,** n. sp.

Externally identical with *neaspersa*, but with the dorsal spine twisted and the lateral process long and crooked. Female unknown. Length 2.9 mm.

Male internal structures.—(Pl. 16.) Lateral process, in lateral view, extending first caudad, then dorsad, and then caudad and slightly mesad, tapering gradually from base to pointed apex. Dorsal spine stout basally, gradually tapering to pointed apex, basal portion extending directly downward, distal portion extending spirally inward, downward, and cephalad. Aedeagus much broadened apically in lateral view. Sternal apodemes rather small, narrowed and bluntly rounded apically, and just reaching to base of fourth segment.

Holotype male and 22 male paratypes from Kremmling, Colo., July 17, 1935 (Oman). There are also at hand two males from Durango, Colo., July 2, 1933 (Oman) and one male from Indian Creek, Utah, July 27, 1932 (Knowlton). Type, U. S. National Museum No. 51627. Three paratypes deposited in collection of the entomological laboratory, Arlington Experiment Farm, Arlington, Va.

14. **Empoasca spiculata,** n. sp.

Differing from other members of the *aspersa* group in the character of the dorsal spine, which has a blunt rounded projection on the caudal margin basally. Female unknown. Length 3 mm.

Male internal structures.—(Pl. 17.) Lateral process relatively long and broad, in lateral view curved slightly dorsad and almost parallel margined to near apex, which is sharply pointed; in ventral view with inner margin slightly sinuous. Dorsal spine broad basally, with a short, blunt, lobelike projection

on caudal margin; remainder of spine long, slender, and spikelike, directed ventrad and slightly mesad. Aedeagus simple and rather slender. Sternal apodemes fuscous, broad basally, broadly rounded apically, and extending beyond base of fourth segment.

Holotype male from Strawberry Dam, Utah, July 16. 1935 (Oman). Paratypes, four males from Snyderville, Utah, July 16, 1935 (Oman). Type, U. S. National Museum No. 52788.

15. **Empoasca ensiformis,** n. sp.

A relatively robust species, with the distal portion of the lateral process somewhat sword-shaped in lateral view. Length 3.25 mm.

External characters.—Head mottled with pale greenish yellow, pronotum with irregular spots of sordid greenish yellow and pale fuscous, fore wings distinctly mottled with fuscous. Posterior margin of seventh sternite of female almost truncate or occasionally faintly trisinuate.

Male internal structures.—(Pl. 17.) Lateral process, in lateral view, with basal half extending caudad, distal half directed caudad and slightly dorsad; dorsal margin with a shallow, rounded emargination at about the middle; apex pointed. Dorsal spine broad and somewhat sinuous, curving slightly cephalad from base, then ventrad, with tip directed slightly cephalad and mesad. Aedeagus short and relatively stout. Sternal apodemes broad basally, apically fuscous and subtruncate, extending to base of fifth segment.

Holotype male, allotype female, and 16 male and 16 female paratypes from south of Bend, Oreg., July 2, 1935 (Oman). Also two male paratypes from Bend, Oreg., and two male and five female paratypes from north of Bend, Oreg., all collected July 2, 1935 (Oman). Type, U. S. National Museum No. 52789. Six paratypes deposited in collection of the entomological laboratory, Arlington Experiment Farm, Arlington, Va.

16. **Empoasca xerophila,** n. sp.

Larger and darker than *aspersa*, and with both dorsal spine and lateral process sharply pointed in lateral view. Length 3.25 mm.

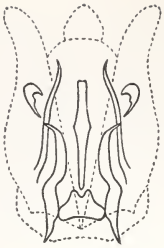
External characters.—Head, pronotum, and scutellum sordid yellowish green to whitish green, without definite markings. Fore wings pale greenish white distinctly mottled with smoky fuscous; veins distinct. The seventh sternite of what appears to be the female of this species is slightly produced and rounded posteriorly, with a very shallow median emargination.

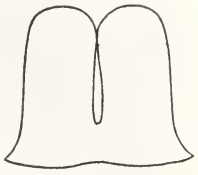
Male internal structures.—(Pl. 17.) Lateral process, in lateral view, curved slightly dorsad, broadened before apex, and ending in a sharp point directed posteriorly; in ventral view with margins sinuous, inner margin swollen about one-third the distance from posterior extremity and concavely sinuate from there to apex. Dorsal spine stout, tapering to a sharp point, slightly twisted but extending directly ventrad. Distal portion of aedeagus much broadened. Sternal apodemes broad and relatively short, broadly rounded and fuscous distally.

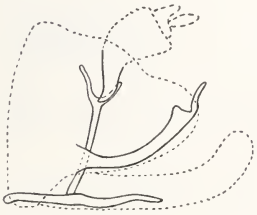
Holotype male and six male paratypes from Grizzly Creek, Colo., July 24, 1896 (C. F. Baker No. 2158). Also three male paratypes from the same locality



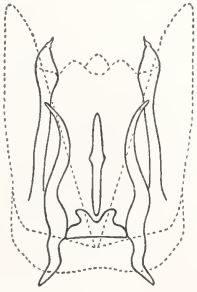
1 VASTITATIS

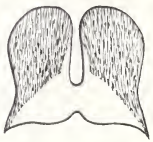






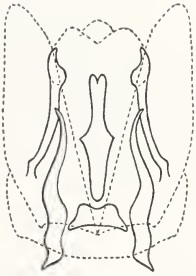
2 MEDORA

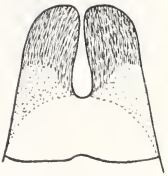


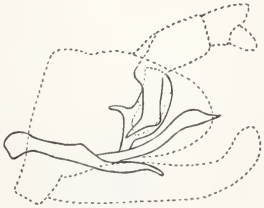




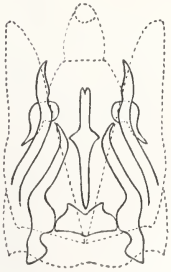
3 VERMISPINA

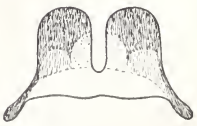


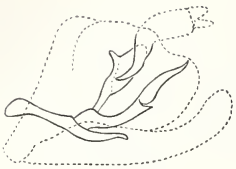




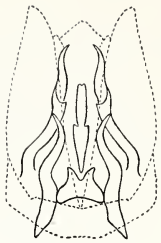
4 ASPERSA



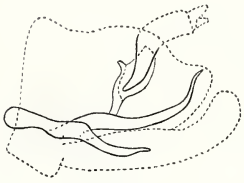




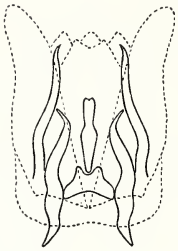
5 NEASPERSA

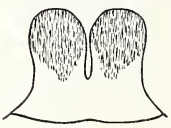


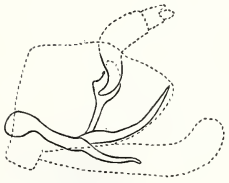




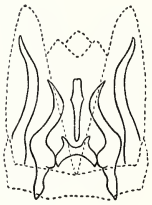
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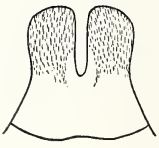


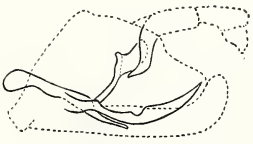




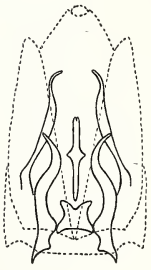
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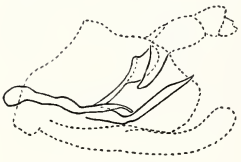




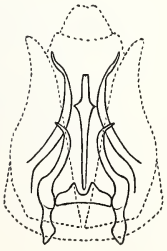
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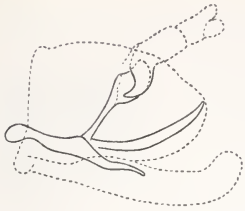




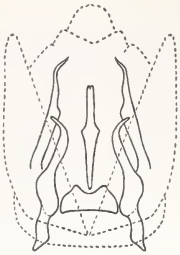
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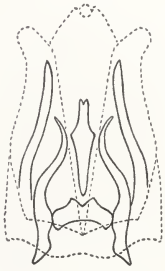
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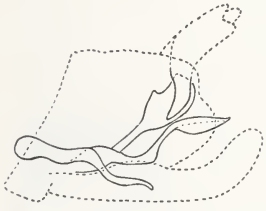




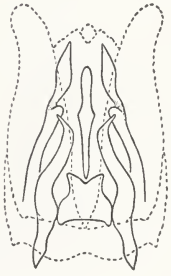
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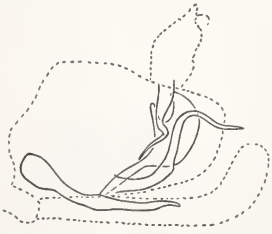




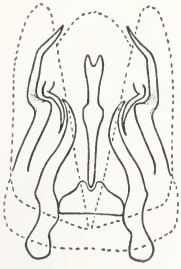
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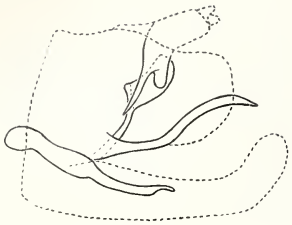




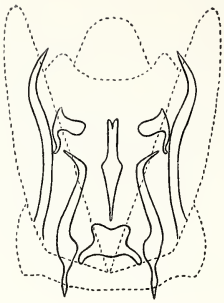
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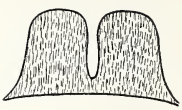


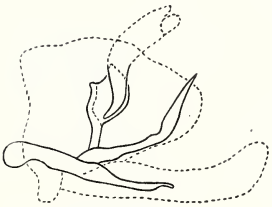




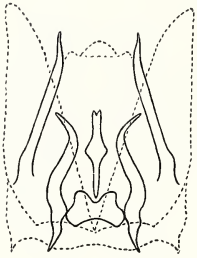
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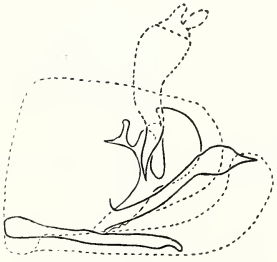




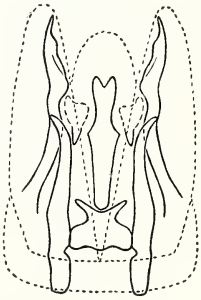
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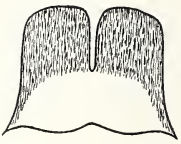


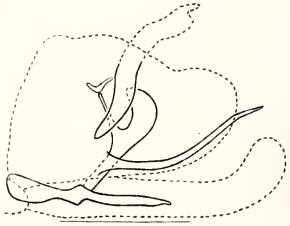




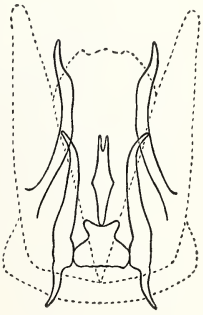
16 XEROPHILA







17 FUSCOVIRIDIS





but collected July 19, 1896, from *Artemisia tridentata* (C. F. Baker No. 2193). There are numerous females at hand from the above locality which are believed to be this species. There is also at hand one male of this species from Moran, Wyo., July 19, 1936 (Knowlton). Type, U. S. National Museum No. 52790.

17. **Empoasca fuscoviridis,** n. sp.

Related to, and superficially identical with, *xerophila*, but slightly more robust, with dorsal spine less sharply pointed, and lateral process more slender. Female unknown. Length 3 mm.

Male internal structures.—(Pl. 17.) Lateral process, in lateral view, rather slender, curving slightly upward, distal portion slightly recurved, tip pointed; in ventral view inner margin slightly sinuous and shallowly emarginate just before apex. Dorsal spine stout, slightly curved cephalad, and bluntly pointed. Posterior portion of aedeagus slightly broadened distally in lateral view. Sternal apodemes narrowed distally, obliquely truncate apically.

Holotype male and two male paratypes from Grizzly Creek, Colo., July 24, 1896 (C. F. Baker No. 2158). Also one male paratype from Ft. Collins, Colo., June 13, 1895 (C. F. Baker No. 1563). Type, U. S. National Museum No. 52791.

OBITUARY NOTICE: MAURICE CROWTHER HALL.

By E. A. Chapin and J. S. Wade.

Maurice Crowther Hall (1881–1938), American zoologist, parasitologist, educator, lecturer, and member of the Entomological Society of Washington since October 3, 1907, was born at Golden, Colorado, July 15, 1881. He was a son of George Hemingway Birtby and Marion Wallace (Crowther) Hall. He received his B. S. degree in 1905, from Colorado College, Colorado Springs, Colorado. He was graduated in 1906, M. A., from the University of Nebraska; Ph. D. in 1915, and D. V. M. in 1916, from George Washington University. In 1925 he received an honorary degree of D. Sc. from Colorado College. He married Lola May Davis of Colorado Springs, Colorado, June 18, 1906. Their children are (Mrs.) Marion Millicent (Holland), Winifred Lois and (Mrs.) Margaret Lola (McCormick).

In 1904 he accepted a position as instructor of botany and physiology at Cutler Academy, Colorado Springs, Colorado, and in 1905 became instructor of biology and chemistry in the Canyon City, Colorado, high school, where he continued until 1907, when he entered the Zoological Division of the Bureau of Animal Industry, U. S. Department of Agriculture, as Junior Zoologist. In 1911 he was advanced to Assistant Zoologist and served until 1916. He was also professor of zoology and parasitology in the College of Veterinary Medicine of George Washington University 1914–1916. During the period 1915–1916 he served as Assistant Zoologist on the U. S. Insecticide and

Fungicide Board, and from 1916–1918 was parasitologist in the research laboratory of Parke Davis & Company of Detroit, Michigan. In 1918–1919 he became 2nd Lieutenant and later 1st Lieutenant in the Veterinary Corps, U. S. Army. In 1917 he returned to the Zoological Division, serving as Senior Zoologist until 1925, when he became Principal Zoologist and Chief of Division. From April 1, 1936, until his death he was Professor of Zoology and Chief of the Division of Zoology, National Institute of Health, U. S. Public Health Service. From 1928 to 1931 he served as Assistant Custodian of the Helminthological Collections of the U. S. National Museum and subsequent to 1931 was its Custodian. In 1930 he was President of the Permanent International Commission of Parasitology of the International Zoological College, and in 1934 was President of the International Commission on Control of Parasites at the International Veterinary Congress. From 1929–1935 inclusive he was a member of the National Research Council.

In addition to his membership in our Society he was a Fellow of the A. A. A. S., a member of the Helminthological Society of Washington (Secretary 1910–1916, 1919–1922, President 1922–1923); American Veterinary Medical Association (President 1930–1931); American Society of Tropical Medicine; American Academy of Tropical Medicine; American Society of Parasitologists (President 1931–1932); American Asso. of Economic Entomologists; Entomological Society of America; Phi Beta Kappa; Sigma Xi; Foreign member of the Royal Academy of Agriculture, Turin, Italy. In 1915–1916 he was delegate to the 2nd Pan American Scientific Congress, Washington. During the period 1907 to 1938 inclusive, he wrote three books—"Diagnosis and Treatment of Internal Parasites" (1st and 2nd editions 1923, 3rd edition 1924), "Worm Parasites of Domesticated Animals," 1924, and "Control of Animal Parasites," 1936. In addition to above he was also author of 551 publications of varying length and scope dealing with parasitic forms from zoological, medical and economic standpoints, and especially with anthelminthic treatment. He proposed the carbon tetrachlorid treatment and with Dr. J. E. Shillinger, the tetrachlorethylen treatment for hookworm disease. Of special interest to members of this Society are his papers dealing with the control of insects affecting domestic animals and his compiled compendium of arthropod hosts of parasitic worms (1929. Smithsonian Misc. Coll., Vol. 81, #3024, pp. 1–77).

Dr. Hall departed this life at Walter Reed Hospital on Sunday, May 1, 1938, and his ashes were interred on May 4th with full military honors at Arlington National Memorial Cemetery. For additional published biographical data concerning him see: Who's Who in America, v. 19, p. 1075, 1936–37; American Men of Science, 5th ed., p. 458, 1933; Who's Who in Government, v. 2, p. 597, 1932; Who's Who in the Nation's Capital, pp. 398–399, 1934–35; Who's Who in the East, pp. 923–924, 1930; Rus, Who's Who in Agriculture, 4th ed., p. 284, 1930.



MAURICE CROWTHER HALL

NEW SPECIES OF CACTOPINUS SCHWARZ (COLEOPTERA: SCOLYTIDAE).

By M. W. Blackman,
Senior Entomologist, Division of Insect Identification, Bureau of Entomology and Plant Quarantine.

The remarkable scolytid genus *Cactopinus* and the species *C. hubbardi* upon which it is based were described by Schwarz[1] in 1899, from a series of several hundred specimens collected by H. G. Hubbard in December, 1896, in a single cavity made by birds in the trunk of a giant cactus (*Cereus*) *Carnegiea gigantea* (Englm.), B. & R., near Tucson, Ariz. Although many collectors have since attempted to find this species in giant cactus, there is no record of additional specimens having been obtained and it is believed that all now in collections are derived from this original lot collected by Hubbard.

For many years, however, the National Museum has contained several undescribed species from other sources. Two of these species are represented by ample series taken by A. D. Hopkins from *Pinus* in Kern and Ventura Counties, and from *Rhus* in Ventura County, Calif., while another species is represented by two specimens, a male and a female, collected by A. Koebele in the Argus Mountains, Inyo County, Calif. These new species are described in the present paper.

It is hoped that the following key will be of service in separating the four known species of the genus, although the writer realizes that references to average sizes or conditions will be of little use in the case of single specimens or small series. However, specimens of *Cactopinus*, when found at all, will usually occur in colonies. One great difficulty, in making a practical key to the group, is due to the nearly universal presence of an incrustation which obscures, or even conceals, structures which otherwise would be of value in identification.

Key to the Known Species of *Cactopinus*.

A. Elytra very broadly, subtruncately rounded behind; the declivital sulcus deep and broad, originating near the middle of the elytral disc.

B. Larger, averaging about 2 mm. in length; stouter, about two and one-third times as long as wide; epistomal horn of male averaging nearly a millimeter in length; in giant cactus, southern Arizona ..... 1. *hubbardi* Schwarz.

BB. Smaller, maximum length 2 mm.; more slender, about two and two-thirds times as long as wide; epistomal horn of male averaging less than .5 mm. in length; in *Pinus jeffreyi*, southern California ..... 2. *pini*, new species.

[1] Psyche, 8, suppl. 1 : 11–13.

AA. Elytra moderately broadly rounded behind; the declivital sulcus rather shallow, originating well behind the middle of the elytral disc.

B. Declivital sulcus moderately shallow and narrow; lateral elevations more evidently granulate; strial punctures finer; setae finer; in *Rhus* ..... 3. *rhois*, new species.

BB. Declivital sulcus shallower but wider; lateral elevations very finely granulate; strial punctures coarser; elytral setae coarser ..... 4. *koebelei*, new species.

Cactopinus hubbardi Schwarz.

Cactopinus hubbardi Schwarz, Psyche 8, suppl. 1 : 11–13, 1899.

The original description of this species is so excellent that there is no need of a redescription. However, it is desirable that certain data be supplied to serve as a basis of comparison with the additional species described herein.

Cactopinus hubbardi is larger and stouter than the other species, being 1.6 to 2.34 mm. in length, 2.34 to 2.37 times as long as wide, with the average length about 2 mm. The largest and smallest individuals seen are both females, but the average size is about the same for each sex. The epistomal horn of the male ranges from .2 to 1.1 mm. in length, the average being slightly less than 1 mm. The antennal club is wider than in the other species and the sutures are more easily discerned. The elytra are notably stouter than in any other known species. The declivital sulcus originates near the middle of the elytral disc as in *C. pini*. The setae are more slender than in other species and are relatively much shorter than in *C. pini*.

In his original description Schwarz did not designate a holotype, but cited the entire series, which are therefore cotypes. It now seems desirable that a lectotype be chosen from the long series of cotypes, and one has been chosen as follows:

A male 2.14 mm. long, 2.34 times as long as wide, widest through the elytra, and showing the characters as described by Schwarz. The lectotype is reddish brown in color and therefore does not show the full adult coloration, but is chosen because such specimens are not so heavily incrusted as older ones and the setae are not abraded.

Type locality.—Tucson, Ariz.

Host.—(*Cereus*) *Carnegiea gigantea* (Englm.) B. & R.

Type material.—Lectotype and 319 paratypes, Cat. No. 4564, U. S. National Museum.

The lectotype and all the paratypes were collected by H. G. Hubbard, December 31, 1896, at Tucson, Ariz., from a single cavity in a giant cactus. Twenty-six of the paratypes bear the labels of the Hopkins, West Virginia, Collection, and five paratypes are in the writer's private collection, received through the kindness of Dr. Schwarz.

Cactopinus pini, new species.

Similar to *Cactopinus hubbardi*, but slightly smaller in average size (1.5 to 2 mm. in length), and distinctly more slender. The male with the hornlike process somewhat shorter and sometimes greatly reduced.

Male.—Piceous to black, 1.6 to 2 mm. long (holotype 1.9 mm. long, 2.6 times as long as wide), with the body usually more or less completely covered with an incrustation that obscures and sometimes completely conceals the sculpture of the pronotum and elytra.

Front of the head distinctly, broadly concave, its surface, where not concealed by the incrustation, shiny, finely, closely punctured, and with inconspicuous fine hairs. *Eyes* usually concealed by the retraction of the head, and by a dense fringe of coarse, cinereous hairs on the prothoracic margin. *Antenna* with scape shorter than funicle, expanded distally, with a few rather long, spatulate setae on the outer convex edge; funicle five-jointed, the pedicel urn-shaped, both longer and wider than the other joints, the two distal joints widened, especially the last one, with shorter spatulate setae; club small, ovate, scarcely wider than the scape (much smaller than in *hubbardi*), the first two sutures distinctly constricted, the third indistinct, not constricted, the surface covered and obscured by long, coarse, appressed setae, which converge at the distal end of the club. *Epistoma* armed with a horn[2] very similar to, but shorter and usually stouter than, in *hubbardi*, extending upward and backward as far as the middle of the pronotum in the holotype, but in some paratypes so short as not to extend beyond the anterior edge of the pronotum.

Pronotum slightly longer than wide (27 : 25), the sides arcuate, with the posterior angles strongly rounded; anterior margin very broadly rounded, with a dense fringe of coarse cinereous hairs on its cephalic margin; base more feebly rounded, but the true outline obscured by the backward extension of a strongly elevated area, occupying the median third of the disc and armed with strong tubercles or asperities. This elevation extends backward from near the anterior pronotal margin, reaches its greatest height in the posterior third of the prothorax, and posteriorly becomes narrower and extends freely as a lobe beyond the true posterior margin, over the scutellum. Surface of pronotum nearly always so covered by an incrustation as to conceal finer and to obscure coarser sculpture, causing the surface to appear dull, devoid of punctures, and nearly devoid of hairs. In cleaned specimens the surface is brightly shiny, very finely, densely punctured, and granulate on the lateral thirds of the disc; the entire surface, including the median elevation, with rather sparse, coarse, usually curved setae of moderate length.

[2] Schwarz's description of this structure in *Coctopinus hubbardi* is so excellent and in general applies so well to that in *C. pini* that we can do no better than quote the following portions: The epistomal horn "is composed of two nearly cylindrical rods which are laterally connate and of equal width from the base to near the tip. The anterior and posterior sides of this horn are shining and more or less distinctly tuberculate, the lateral margins are densely tuberculate and apparently irregularly serrate and furnished with a fringe of moderately long hairs. Some distance from the tip each rod is angularly contracted laterally, and only the inner half of each is prolonged into a shining, cylindrical prong-like process averaging about one-eighth the length of the horn. The prongs are distinctly separated from each other. . . ."

Elytra equal in width to the pronotum, 1.48 times as long as wide, the sides subparallel for three-fourths their length, very broadly rounded, subtruncate behind; the surface often covered by an incrustation, and then appearing dull, and with the finer sculptural details concealed or obscured. In cleaned specimens, the surface is brightly shiny, the striae hardly impressed, the strial punctures coarse and close; the interspaces narrower, somewhat convex, finely granulate-punctate, and ornamented with long, coarse, stiff, curved hairs, those on the sides and posterior angles being especially long, curved and directed backward at an angle. Sutural striae impressed anteriorly, posteriorly developing into a broad sulcus involving both sutural striae and interspaces and becoming progressively deeper posteriorly; the *declivity* abrupt, steep, deeply and broadly sulcate, the lateral elevations high, the third interspaces forming its summits, strongly granulate.

Female.—Averaging only slightly less in length; the allotype 1.7 mm. long, 2.68 times as long as wide; front of head transversely impressed above the epistoma, convex above, very finely, rather closely punctured, with rather fine, short, cinereous hairs. Pronotum with base rounded, sides strongly arcuate, distinctly constricted before middle, the front very broadly rounded; posterior lobe of pronotal elevation not so strongly extended posteriorly. Elytra essentially similar to those of the male.

There is considerable variation in the type series of 50 specimens studied. The size ranges from 1.5 to 2 mm.; the extent, shape, and degree of elevation of the asperate elevated area on the pronotum vary considerably not only between the sexes but in different individuals of the same sex; the hornlike epistomal process ranges in length from .17 to .57 mm.; and there is the usual range of variation in the pubescence, size of punctures, etc.

Type locality.—Griffen, Kern County, Calif.
Other locality.—Ventura County, Calif
Host—Pinus jeffreyi ("Oreg. Com.").
Type material.—Holotype, allotype, and 50 paratypes, Cat. No. 52794, U. S. National Museum.

Described from 52 specimens. The holotype and 28 paratypes were collected near Griffen, Kern County, Calif., by A. D. Hopkins, in Jeffrey pine, April 4, 1909. The allotype and 22 paratypes were taken from old dead branches of Jeffrey pine, Ventura County, Calif., November 13, 1905, by A. D. Hopkins.

Cactopinus rhois, new species.

Similar to both *Cactopinus hubbardi* and *C. pini*, but smaller than either (1.34 to 1.8 mm. long), slightly more slender than the former, the epistomal horn in the male shorter than in either.

Male.—Piceous to black, ranging from 1.4 to 1.78 mm. long; the holotype 1.7 mm. long, 2.66 times as long as wide, with the surface structures more or less obscured by an incrustation covering all parts of the body.

Front of the head broadly concave, in specimens in which it is not concealed by the incrustation, shiny, the punctures fine and close, the hairs cinereous,

fine and short, slightly longer at the periphery; epistomal horn similar to that in *hubbardi* and *pini* but shorter than in either of these species, extending not more than one-fifth of the way back on the pronotum in the type, but sometimes very short, with the end not attaining the thoracic margin; general structure similar to that in the other species of the genus. *Eyes* finely granulate, usually partly or wholly concealed by the pronotal margin. *Antenna* larger than in *pini*, mounted specimens showing the scape as long as the funicle, flattened and expanded distally, the outer edge with coarse, rather long, spatulate setae; funicle five-jointed, with the urn-shaped pedicel comprising one-third of its length, the second, third, and fourth joints narrower, the fifth distinctly widened and applied closely to the base of the club, the coarse, spatulate setae of moderate length; club larger than in *pini*, distinctly wider than the scape, with the arrangement of sutures and setae similar to that in *pini*.

Pronotum almost exactly as wide as long, posterior outline feebly arcuate, posterior angles strongly rounded, sides distinctly arcuate, very feebly constricted in front of middle, moderately broadly rounded on anterior margin, with a dense fringe of short, coarse, cinereous setae entirely surrounding head-socket; central third of surface occupied by an asperate area, similar to but somewhat less strongly elevated than in *hubbardi* and *pini*, arising back of anterior margin, highest in posterior third; narrowed posteriorly and forming a lobe which extends backward, slightly overlapping the true posterior margin. Surface of pronotum covered by an incrustation, not so abundant as in *hubbardi* and *pini*, but usually sufficient to conceal or obscure most of the sculptural details. In cleaned specimens the surface is brightly shiny, very finely, closely punctured on the lateral thirds, with sparse, rather coarse, moderately long, curved setae which are often abraded.

Elytra very slightly wider than pronotum, 1.56 times as long as wide, the sides subparallel for two-thirds of their length, moderately rounded behind (more narrowly than in *pini*). Surface covered by an incrustation which conceals the finer details and causes the surface to appear dull. In cleaned specimens the surface is brightly shiny; the first striae impressed, the others punctate-striate, not impressed, the strial punctures moderate in size (finer than in *hubbardi* and *pini*) and close; interspaces narrower than striae, rugulose-granulate, with very fine inconspicuous punctures, with moderately fine, moderately long, curved setae (much finer and shorter than in *pini*). Sutural area not broadly impressed on the disk as in *hubbardi* and *pini*. Declivity less abrupt than in the other species, the sulcus moderately wide, much more shallow than in *hubbardi* and *pini*, the lateral elevations less high, with a row of fine granules in both the second and third interspaces.

Female.—Similar in size to the male; the allotype 1.6 mm. long, 2.54 times as long as wide, widest through the elytra; epistomal horn lacking; frons above very finely and densely punctured; pronotum with lobe of elevated area not extending beyond the true margin behind, declivity similar to that of male, with both second and third interspaces granulate, the latter more coarsely so.

Exhibits about the same degree of variation as *Cactopinus pini*. The length ranges from 1.34 to 1.8 mm. The epistomal horn ranges in length from .11 to .31 mm. The elevated, asperate area of the pronotum varies to about the same degree as in other species of the genus.

Type locality.—Ventura County, Calif.

Host.—*Rhus integrifolia* (Nuttall) Bentham & Hooker.

Type material.—Holotype, allotype, and 39 paratypes, Cat. No. 52795, U. S. National Museum.

Described from 41 specimens. The holotype, allotype, and 39 paratypes were taken from the bark of mahogany sumach cut the preceding winter, in Ventura County, Calif., by A. D. Hopkins, April 6, 1906, or later reared from this infested material.

Cactopinus koebelei, new species.

Similar in size to *Cactopinus rhois*, but intermediate in structure between this species and *C. pini*.

Male.—Piceous in color, 1.7 mm. long, about 2.65 times as long as wide; body surface obscured by an incrustation as in other species of the genus; setae coarser than in *C. rhois*, but shorter than in *C. pini*.

Front of the head concave, the surface shiny, finely, closely punctured, with fine, short hairs, more conspicuous at the sides. The hornlike process arising from the epistoma similar to those in other species, .46 mm. long in the holotype. *Eyes* finely granulate, partly concealed by the pronotal margin. *Antenna* with the scape expanded distally and ornamented on its outer edge by stout, moderately long setae, funicle and club similar to those of *C. rhois*.

Pronotum about as wide as long, posterior outline somewhat arcuate, posterior angles strongly rounded, sides arcuate, moderately broadly rounded in front, with a close fringe of cinereous setae entirely surrounding the head socket; details of structure of upper surface concealed by an incrustation, but doubtless essentially similar to those of other species; the median, elevated, asperate area as in other species, with the posterior portion forming a lobe which extends beyond the true posterior margin.

Elytra slightly wider than pronotum, 1.55 times as long as wide, the sides subparallel on the anterior three-fourths, rather broadly rounded behind; surface shiny where the incrustation is lacking; the first striae moderately impressed anteriorly, very strongly impressed near the declivity, the other striae not impressed; strial punctures close, moderately coarse (coarser than in *C. rhois*); interspaces narrow, rugulose-granulate, with fine punctures, bearing setae that are coarser than in *C. rhois* and much shorter than in *C. pini*. *Declivity* moderately sloping, the sulcus rather shallow, with the lateral elevations only moderate; second and third interspaces very finely granulate; suture moderately elevated and feebly granulate.

Female.—Smaller, 1.37 mm. long, 2.52 times as long as wide, widest through elytra; frons transversely impressed above epistoma, convex above, very finely and closely punctured, the hairs for the most part abraded or hidden by the incrustation; pronotum with lobe of median, asperate elevation scarcely extending beyond true posterior margin. Elytra with most of the surface details concealed by incrustation; declivity shallower and the setae shorter than in the male.

Type locality.—Argus Mountains, Inyo County, Calif.

Host.—Unknown.

Type material.—Holotype and allotype, Cat. No. 52796, U. S. National Museum.

Described from two specimens, a male and a female, collected by A. Koebele in Inyo County, Calif., and bearing the labels, "Argus Mts., May, '91; A. Koebele collector." The Argus Mountains are near the western border of Death Valley, 20 to 30 miles southeast of Owen's Lake.

NOTES ON THE LEGIONARY ANTS (ECITON, SUBGENUS ACAMATUS) WITH A RECORD OF NEW SPECIFIC SYNONYMY.

By Marion R. Smith,

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Fifteen species and one subspecies of legionary ants (*Eciton*, subgenus *Acamatus*) are recorded from America, north of Mexico. Unfortunately many of these are known only from a single caste. The remarkable differences that exist between the castes of the same species make determination extremely difficult. The queen is of gigantic size compared with the workers, and like them she is either blind or practically so, and apterous during her entire life. Unlike the workers, she possesses a single-segmented petiole instead of a two-segmented one. The males are large, elongate, wasplike insects with very large eyes, and characteristic mandibles and hypopygia. As the males are seldom taken in nests with the other castes, but are usually collected at lights, the problem of clearing up the association of males with workers has progressed very slowly. Since approximately 1900, males have been found associated with workers in only four species: *opacithorax* Emery, *carolinensis* Emery, *nigrescens* (Cresson), and *pilosum* F. Smith.

In general, the ants of this subgenus abound in the southwestern section of the United States, but at least three species (*opacithorax*, *carolinensis*, and *nigrescens*) range as far east as the Atlantic Seaboard and thence north to Virginia, and one species (*nigrescens*) extends at least as far north as Iowa.

These ants are known as being predacious on termites, the brood of other ants, the larvae of flies, etc. Since many of the insects attacked are injurious to mankind, the legionary ants are on the whole beneficial.

TABLE SHOWING THE VARIOUS SPECIES OF ECITON (ACAMATUS) RECORDED FOR THE UNITED STATES, THEIR GENERAL DISTRIBUTION, AND THE ASSOCIATED CASTES OF EACH.

SPECIES	DISTRIBUTION	WORKER	QUEEN	MALE
E. (*A.*) *opacithorax* Emery	Tex. to Kans. and east to Fla. and Va.	X	X	X
E. (*A.*) *carolinensis* Emery	Miss to Fla. and north to Va.	X	X	X
E. (*A.*) *pilosum* F. Smith	Mex. to Ariz. and east to Miss.	X	X	X
E. (*A.*) *nigrescens* (Cress.)	Tex. to Iowa, and east to Fla. and Va.	X	X	X
E. (*A.*) *wheeleri* Forel	Tex.	X	–	–
E. (*A.*) *wheeleri* subsp. *dubia* Creight.	Tex.	X	X	–
E. (*A.*) *pauxillum* Whlr.	Tex.	X	–	–
E. (*A.*) *commutatum* Emery	Tex., Kans., Okla.	X	–	–
E. (*A.*) *californicum* Mayr	Calif., N. Mex.	X	–	–
E. (*A.*) *leonardi* Whlr.	Calif.	X	–	–
E. (*A.*) *oslari* Whlr.	Ariz.	–	–	X
E. (*A.*) *minus* (Cresson)	Tex., Kans.	–	–	X
E. (*A.*) *melsheimeri* (Hald.)	Tex., Utah	–	–	X
E. (*A.*) *harrisi* (Hald.)	Tex., Utah, N. Mex, Ariz.	–	–	X
E. (*A.*) *spoliator* Forel	Tex.	–	–	X
E. (*A.*) *arizonensis* Whlr.	Tex., Ariz., N. Mex.	–	–	X

An examination of the table shows that there are five species and one subspecies of which the male is unknown or unrecognized: *wheeleri*, *wheeleri dubia*, *pauxillum*, *commutatum*, *californicum*, and *leonardi*; and six species known only from the male caste: *oslari*, *minus*, *melsheimeri*, *harrisi*, *spoliator*, and *arizonensis*. It is only natural to infer that some of the species now known only from males will later be associated with certain species at present known only from workers, and thus a number of specific names synonymized. It is not even improbable that the 12 specific names now representing both male and workers' castes may eventually be reduced to six specific names, in which event the total known forms belonging to this subgenus in the United States would drop from 16 to 10.

The primary purpose of this article, however, is to synonymize Emery's *schmitti* with Cresson's *nigrescens*. Cresson described *nigrescens*, in 1872, from a single male specimen collected by Belfrage in Bosque County, Tex. In 1908 Wheeler redescribed *nigrescens* from a male specimen in the United States National Museum collection bearing the label "Kansas." Wheeler stated that he considered this specimen to agree fully with Cresson's description "except that the wings are paler and possibly faded with age." In 1895 appeared the first complete

description of *E.* (*A.*) *schmitti* based on workers sent to Emery by Theo. Pergande from Doniphan, Mo. The first mention of the species by Emery, however, was in a key to the workers of *Eciton*, subgenus *Acamatus*, which appeared in 1894. In November, 1899, Wheeler was fortunate enough to find on Mt. Bonnell, near Austin, Tex., a colony of *schmitti* containing numerous males. Specimens of these males were submitted to Emery, who on examining them wrote Wheeler he was inclined to regard them as *nigrescens*. Wheeler then sent specimens to Fox, who compared them with the type of *nigrescens* in the Academy of Natural Sciences of Philadelphia, and wrote Wheeler that they were "too hairy for *nigrescens*, which is entirely brownish. The first segment of *nigrescens* is shorter and the wings light." Fox's comments led Wheeler and Long, in 1901, to consider *schmitti* distinct from *nigrescens*, and they therefore gave a very thorough description of the Mt. Bonnel males, calling them *schmitti*. From that date the two have continued to stand as distinct species, all castes of *schmitti* having been subsequently found and described, while *nigrescens* has been recognized only from the male.

Recently, while examining and rearranging the species of *Eciton*, subgenus *Acamatus*, in the collection of the United States National Museum, the writer found two instances of the association of workers of *schmitti* and males of *nigrescens:* One male and several workers collected in a basement in Quincy, Ill., by T. E. Musselman; and one male concerning which the collector, L. G. Wesson, writes, "The male was taken with workers about the middle of November in a locality about 15 miles from Nashville, Tenn. I noted no difference in form or behavior from the common *schmitti*." Also among specimens borrowed from the Department of Entomology of the Kansas State College were found several workers and a male bearing the label "Riley County, Kansas; Sept. 27; J. B. Norton; Acc. No. 1381." The workers in each group were typical *schmitti*. The three males were compared by the writer with the type of *nigrescens* and show only the following variations from the type:

The male from Quincy, Ill., differs only in that the head and thorax are darker, the pubescence longer and more yellowish, the ridge above each antennal fossa more pronounced, and the mandibles more elongate, with acute tips.

The male from near Nashville, Tenn., is much darker than the type, this being especially true of the gaster; the ridge over the antennal fossa is more strongly developed than in either the type or the Illinois specimen, but the mandibles are more of the same shape as in the latter; the apical margins of the gastric segments are constricted, but not so reddish as in the type of *nigrescens*.

The Kansas male also is darker than the type, but more similar to it in color than is either the Illinois or the Tennessee

male; the ridge over the antennal fossa is also more strongly developed than in the type.

After examining males which agree with Wheeler's description of *schmitti*, the males mentioned above, and the type of *nigrescens*, it is clearly evident that all of these should be referred to *nigrescens*, although there is considerable variation among the males in color, pilosity, shape of the mandibles, and shape of the vertex of the head. The hypopygium has three teeth, although the intermediate tooth is very small, and not easily seen unless the specimen is held at the proper angle. Mesonotal ridges are also present on all the males but they are more evident on the specimens having the least pubescence on the thorax. The male described by Wheeler and Long as *schmitti* represents a form possessing a lighter gaster, a more glabrous body, and longer and more yellowish pubescence. Cresson's type, and the males from Illinois, Tennessee, and Kansas, represent other variants which have darker bodies, shorter and lighter pubescence, more pronounced ridges over the antennal fossae, and less elongate, acutely tipped mandibles.

The synonymy of the two species is given below:

Eciton (Acamatus) nigrescens (Cresson).

Labidus nigrescens Cresson, Trans. Amer. Ent. Soc., Vol. 4, p. 194 (1872). *Male.*

Eciton sumichrasti Mayr (part) (not Norton), Verh. Zool. Bot. Ges. Wien., Vol. 36, p. 440 (1886). *Worker.*

Eciton (*Labidus*) *nigrescens* (Cresson), Emery, Zool. Jahrb. Syst., Vol. 8, p. 261 (1894). *Male.*

Eciton (*Acamatus*) *schmitti* Emery, Bull. Soc. Ent. Ital., Vol. 26, p. 183 (1894). *Worker.* New synonymy.

Eciton (*Acamatus*) *schmitti* Emery, Zool. Jahrb. Syst., Vol. 8, p. 258 (1895). *Worker.*

Eciton sumichrasti Wheeler (not Norton), Amer. Nat., Vol. 34, pp. 563–574 (1900). *Queen A*, *Queen B.*

Eciton (*Acamatus*) *schmitti* Emery, Wheeler and Long, Amer. Nat., Vol. 35, p. 161 (1901). *Male.*

Eciton (*Acamatus*) *nigrescens* (Cresson) Wheeler, Bull. Amer. Mus. Nat. Hist., Vol. 24, p. 417 (1908). *Male.*

Eciton (*Acamatus*) *schmitti* Emery, Smith, Ann. Ent. Soc. Amer., Vol. 20, pp. 401–404 (1927. *Worker.*

While examining material from Kansas the writer encountered some evidence that throws suggestive light on the possible synonymy of two other species, the male *minus* (Cresson) and the worker *commutatum* Emery. *E.* (*A.*) *commutatum* has been identified from Kansas specimens on several occasions. It is the smallest *Eciton* known from that State. The male *minus* is also the smallest Kansas *Eciton* known in that caste. It seems not at all unlikely that eventually it may be necessary to synonymize *commutatum* with *minus*.

DESCRIPTION OF THE LARVAE OF CHAETOCNEMA DENTICULATA (ILLIGER) AND CHAETOCNEMA PULICARIA MELSHEIMER (COLEOPTERA : CHRYSOMELIDAE).

By W. H. Anderson,

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The larvae of the genus *Chaetocnema* belong in that group of halticine chrysomelid larvae which have the dorsal side of the abdominal segments transversely divided into three areas, namely prescutum, scutum and scutellum. At present, too few of the species are known in the larval stage to permit of generic characterization. However, the larvae which have been described or figured seem to fall into two groups, one, consisting of *C. aridula* Gyllh. (Fig. 14), *C. aridella* Payk. (Fig. 15), and *C. denticulata* (Ill.) (Fig. 16), in which the scutal sclerites (S) are paired, the other, consisting of *C. pulicaria* Melsh. (Fig. 17) and *C. concinna* Marsh. (Fig. 18), in which the scutal sclerites are united across the mid-dorsal line.

The differences between *Chaetocnema pulicaria* and *C. denticulata* are considerable. The more important are the following: A difference in the comparative length of the epicranial sutures; the fact that the frontal sutures do not extend to the antennal rings in *pulicaria* whereas they do in *denticulata;* and the reduction of the sclerites of the abdominal scuta to vestiges about the setae, in *denticulata*, as compared to their continuity across the mid-dorsal line in *pulicaria*. Of probably secondary significance are; the presence of urogomphi in *pulicaria*, which are lacking in *denticulata*, and the absence of pigment in the sclerites of the body in *pulicaria* and its presence in those of *denticulata*.

It seems probable that when the larvae of more species of the genus *Chaetocnema* are known and critically studied, the two groups, of which *C. denticulata* is an example of one and *C. pulicaria* of the other, will be found worthy of at least subgeneric rank.

The following descriptions are from larvae in the collection of the United States National Museum.

Chaetocnema denticulata (Illiger).

(Described from mature larvae in vial marked "Various stages of larvae, Arlington, Va. 1936. F. W. Poos. Reared.")

Full-grown larva.—About 7 mm. in length and 1 mm. in greatest width; legged, cylindrical and straight. Sides practically parallel, narrowed slightly anteriorly from metathorax and posteriorly from sixth abdominal segment. Body segments, with exception of prothorax and ninth and tenth abdominal segments, bearing small, regularly arranged, pigmented sclerites. Segments separated by grooves, no intersegmental belts or areas being distinguishable.

Head capsule shining, light brown, darker along the postero-dorsal margin of

each epicranial half, endocarina[1] and margins of antennal rings, lighter along anterior border. Mandibles light brown. Postmentum (Fig. 11, MT+SMT) nearly covered by a sclerite which is more heavily pigmented centrally. A narrow, light brown sclerotic band marking the posterior margin of prementum. Maxillary stipes bearing a large sclerite which is brown, becoming darker along outer and anterior margins. General ground color of body dirty white (in preserved specimens). Major portion of prothoracic tergum slightly lighter brown than head capsule; margins of former fading into the light color of exosclerotic integument and hence not readily distinguishable. Pygidial shield of the same shade of brown as prothoracic tergum, with anterior and lateral margins lighter. Thoracic episternal sclerites (Fig. 12, Es) light brown with more heavily pigmented lower margins which are comparable in color to extreme distal margins of coxae and proximal margins of trochanters. Otherwise sclerotized parts of legs having same general color as head capsule. Pulvilli or paronychial appendices (Fig. 12, PP) hyaline. Small spiracular sclerites light brown. Prothoracic sternal plate mostly light brown, with an irregular darker central stripe, the latter broadening near posterior margin of plate. Remainder of body sclerites light tan; body setae brown.

Head broadly oval, slightly longer than wide; somewhat retractile into prothorax, to which it compares in width as 2½ to 4. Capsule with distinct, gently curving frontal sutures (Fig. 2, Fs), converging posteriorly. Epicranial suture (EPS) long, measuring slightly less than one-third the length of head capsule to base of clypeus. Each frontal suture extending anteriorly to posterior margin of antennal ring (Fig. 3, Fs). Frons divided by endocarina (Fig. 2, ENC), which is confluent anteriorly with epistomal thickening (EPS). Epicranial halves (EP) with rounded, very slightly produced hind margins. Frons with three well developed setae on each side; two on an imaginary line connecting anterior margins of antennal rings, one of these, lateral, directly behind dorsal mandibular condyle, one median, about the same distance from endocarina as lateral one is from antennal ring; third seta slightly behind an imaginary line connecting posterior margins of antennal rings and on an imaginary line bisecting angle formed by endocarina and frontal suture. Dorsal epicranial half (EP) bearing six well developed setae placed as follows: One about one-third epicranial width from, and slightly anterior to, union of frontal sutures; a second almost directly in front of the first and separated from it by a distance approximately equal to that between the first and the midline; a third slightly behind second but three-fourths the distance from endocarina to lateral margin of head; a fourth and a fifth close together and immediately behind antennal ring; a sixth slightly behind fifth on dorso-lateral margin of head capsule. Laterally on head one seta, about one-third the distance from antennal ring to posterior margin of epicranium. Five setae on ventro-lateral and ventral surfaces (Fig. 11), as follows: One near pleurostomal margin; a second directly behind this seta but separated from it by a distance equal to one-half width of antennal ring; a third close to but slightly postero-dorsad of second; a fourth directly behind third and separated from it by the distance between first and third; a

[1] The term "endocarina" is here designated for the internal ridge (Fig. 2, ENC), common in coleopterous larvae, which extends partially or completely the length of frons along the mid-line, usually being more heavily pigmented.

fifth situated close to apex of angle formed by maxillary cardo and stipes when mouth parts are retracted. Clypeus (Fig. 1, CLP) about four times as broad as long, with a narrow sclerite at base from which rises a series of three or four pairs of minute setae. Labrum slightly narrower than clypeus and slightly less than three times as broad at base as long. From basal sclerite (LM) arise two pairs of well developed setae, one near lateral margin, the other about one-third labral width from margin. Along anterior margin a rather dense series of setae varying in length and shape.

A small pigmented spot (Fig. 3, Oc), representing ocellus, visible within head in vicinity of posterior limit of antennal socket.

Antenna consisting of one article (Fig. 3, 1AT) from which arise a large sensory appendix (SAP) and several papillae, one (2AT) larger than the others and bifid, this being possibly a rudimentary second article.[2] Large sensory appendix cone-shaped, with a narrow sclerite at base and slightly less than twice as long as basal width.

Mandible (Fig. 9) palmate, inner surface concave, with five distal teeth, of which the third, or median, is longest, the second and fourth subequal and about one-half length of third, and the first and fifth rather short. On inner margin a series of three stiff, rather straight, closely set bristles which decrease in length from the anterior to the posterior one. Exterior face of mandible with two well-developed setae.

Maxilla with a simple transverse cardo (Fig. 7, CD), a rectangular stipes (ST), and a mala divided into lacinia (Fig. 10, LC) and galea (GA). Cardo bearing one seta on outer anterior margin near articulation with stipes, the latter with two setae along exterior margin. Lacinia visible in dorsal view of maxilla (Fig. 10), armed on its distal surface with a tightly bunched group of strong setae, about six in number. Galea (Fig. 7) broad, bearing on its distal surface a group of short setae, among them one distinctly peg-shaped with a cylindrical basal piece (PG). Palpiger (PGR) furnished with a broad sclerotized base from which arise two setae. Palpus (PLP) consisting of three articles, of which the first and second are provided with narrow sclerotic bases. Second article slightly narrower and longer than first, third conical, about as long as, but narrower than second. Each article bearing one or two minute setae or pores, their arrangement being of no apparent taxonomic value.

Labium (Fig. 11) rather distinctly set off from maxillae by posteriorly diverging grooves. Center of postmentum (MT+SMT) covered by a sclerite irregular in shape and degree of pigmentation, much lighter along margins. Two pairs of well-developed setae laterally on postmentum, one pair near posterior margin, the second almost directly in front of the first, about half-way between posterior and anterior borders. Near second pair a third pair of minute setae. Posterior boundary of prementum marked by a transverse double-arched sclerite, from which arises a pair of setae. Labial palpus consisting of two articles, the first broader than long, the second conical, longer than, and about half as wide as, basal article. Ligula indistinctly separated from prementum; and on its broad

[2] See: Patterson, Nellie F. Studies on the Chrysomelidae, Part II. The Bionomics and Comparative Morphology of the Early Stages of Certain Chrysomelidae (Coleoptera, Phytophaga). Proc. Zool. Soc. London, pp. 879–949, illus. 1931.

anterior surface three pairs of small setae, in addition to a pair of small pores probably sensory in nature.

Legs, each consisting of four articles and a claw (Fig. 12), well developed, widely separated; the imaginary lines connecting the coxae diverging posteriorly. Legs of prothorax slightly smaller than others. Coxa of each leg articulated to the heavily pigmented lower margin of corresponding episternal sclerite.

Spiracles normal in size, circular, each enclosed by a sclerite. The latter large on mesothorax and eighth abdominal segment, smaller and less conspicuous on first seven abdominal segments.

Prothorax (Fig. 5) about 1½ times as wide as long, tergal shield rather flat, smooth, in the form of a broad escutcheon, divided along mid-dorsal line by a distinct and jaggedly sinuate whitish suture. Setae on shield arranged as follows: On each side a transverse row of four setae along anterior margin, and a series of three setae in an oblique, curved line from center of lateral margin to near posterior margin at mid-line. In addition several minute setae scattered over the tergal shield. Prothoracic spiracular area (=parascutal area, Böving)[3] inconspicuous. Sclerite of triangular laterotergum (=epipleurum, Böving) well developed, bearing one seta. Presternal sclerite immediately behind posterior margin of epicranium well developed. Episternum large, bearing one well-developed seta and two very small ones. Epimeron bearing one seta. Eusternum and sternellum fused, a large sternal plate about twice as long as wide covering nearly half the common area. Two pairs of setae on plate, one pair approximately three-fourths, the other one-fourth the length of plate from posterior margin. Poststernellum not indicated.

Mesothorax slightly wider than prothorax, and metathorax wider than mesothorax. Arrangement of meso- and metathoracic sclerites identical. These segments differ, however, in the presence of a functional spiracle[4] on the mesothorax. The following description of sclerites and setae will apply to either segment: Tergum anteriorly divided by an obtusely curved, anteriorly concave impression or groove extending to about center of segment medially. Anterior to this impression is the prescutum (Fig. 5, Ps), the scuto-scutellum (S–Scl) lying posterior to it. Each area bearing three sclerites, a single median and a pair of lateral (Fig. 16). Prescutal median sclerite (1) with one pair of setae, each prescutal lateral sclerite (3) with one seta; scuto-scutellar median sclerite (2) with one pair of setae, and each scuto-scutellar lateral sclerite (4) with three setae, one well developed and two small. Spiracular area (=parascutum, Böving) bearing two sclerites, a small anterior one (5) surrounding spiracle and a much larger posterior one (6). Anterior sclerite with one seta, posterior with three well-developed setae and one or two small ones. Laterotergite (=epipleurum auct.) (Fig. 5, LaT and Fig. 16, 7), bearing one small seta placed near posterior margin of segment. Presternal sclerite (Figs. 16 and 17, Pst) small

[3] The morphological interpretation of these areas, with some changes in nomenclature, has been adopted from the following publication: Böving, Adam G. Beetle Larvae of the Subfamily Galerucinae, Proc. U. S. Nat. Mus., Vol. 75, Art. 2 (Sep. No. 2773), 48 pp., illus. 1929.

[4] A vestigial spiracle to which a fine trachea can be traced is present on the metathorax in a position corresponding to that of the mesothoracic spiracle. Note small dot on sclerite No. 5, Figs. 16 and 17, representing its location.

but distinct. Episternum (Fig. 16, 8) smaller than on prothorax, bearing but two small setae. Epimeron with one seta. Eusternum marked with median sclerite bearing one pair of well-developed and one pair of very small setae. Sternellar sclerites (11) distinct and separated, each bearing one seta. Poststernellum not distinguishable.

Abdominal segments 1 to 7 subdivided into three transverse areas, the prescutum (Fig. 5, Ps), the scutum (S), and the scutellum (Scl). Grooves separating the areas discernible, extending a short distance on either side of middorsal line. Each area marked by a transverse row of pigmented sclerites; prescutum with a single median sclerite (Fig. 16, 1), and on each side a paired lateral sclerite (3); scutum with a paired sclerite (S) outside an imaginary longitudinal line between lateral margins of median sclerites of prescutum and scutellum; scutellum with a single median (2) and a pair of lateral sclerites (4). The median sclerite bears one pair of setae and each lateral sclerite one seta. Spiracular area with an anterior (5) and a posterior sclerite (6), each bearing one seta. Glandular openings absent on all of these sclerites. Spiracle between, but somewhat nearer to posterior than to anterior spiracular sclerite, partially surrounded by a sclerite (Sp). Laterotergite (7) large, bearing three setae, one of them very small. Pleuron (=hypopleuron, auct.) with one sclerite (8+9) bearing two setae. Eusternum with a median unpaired sclerite (10) bearing a pair of setae. Sternellum with a pair of sclerites (11) from each of which two setae arise.

Eighth abdominal segment (Fig. 21) similar to preceding but with arrangement of sclerites slightly different; paired lateral sclerites of scutellum fused with median one to form a large sclerite (Fig. 21, 2+4) with two pairs of setae, and the spiracle situated in posterior sclerite of spiracular area (6), which bears three setae, two of them being small.

Ninth abdominal segment (Figs. 5, 19 and 21) about three-fourths width of eighth and slightly shorter, its width to its length as 2 is to 1¾. Pygidial shield approximately saddle-shaped, without urogomphi, but with six well-developed setae on each side (Fig. 21), in addition to three or four minute setae or pores. Five primary setae arranged in an irregular row along margin of shield, two being slightly below margin. Sixth seta situated a little in front of center of shield and approximately one-half distance from mid-line to lateral margin. On ventral surface of segment a transverse unpaired sclerite immediately in front of pygopod (Fig. 21), bearing two pairs of setae.

Tenth abdominal segment developed as a short, obliquely directed pygopod (Fig. 21, XAB). On each side a small pigmented sclerite which does not bear setae. Anal opening in center of under surface of pygopod.

Chaetocnema pulicaria Melsheimer.

(Described from mature larvae in vial marked "Arlington, Va. 25 : X : 1936. F. W. Poos. Larvae No. 178, 173 and others. Reared.")

Smaller than *denticulata*, the full-grown larva measuring about 5 mm. in length and 0.5 mm. in greatest width. Body (Fig. 4) with regularly arranged but nonpigmented sclerites, and with prothorax and pygidial shield only slightly darker than remainder of body sclerites.

Head (Fig. 6) broader posteriorly, with sides nearly straight. Frontal sutures (Fig. 6, Fs) straight, apparently[5] not extending to antennal rings. Epicranial suture short. Epicranial halves more produced posteriorly and roundly angulate. Setal arrangement on head similar to that of *denticulata* except for the two median setae on epicranium, which are more widely separated and considerably farther in front of union of frontal sutures. Grooves separating labium from maxillae nearly parallel, giving to labium a rectangular shape (Fig. 13). Sclerome at base of prementum (PRMT) forming a simple, posteriorly curved arch bearing one pair of setae.

Thorax with arrangement of sclerites and setae as in *denticulata*.

Abdomen with each segment dorsally divided into three transverse areas; sclerites as in *denticulata* except that scutal sclerites are united across mid-dorsal line (Fig. 4, S). Setae on scuta in line with setae on median sclerites of prescuta and scutella. Pleuron with separate sclerites (Fig. 17, 8 and 9), each with one seta.

Ninth abdominal tergum armed with small urogomphi (Figs. 20 and 22, UR) directed upward and slightly backward. Pygidial shield on each side armed with seven primary setae (Fig. 20), five arranged along lateral and posterior margins, two on dorsal surface. Tenth abdominal segment without pigmented sclerites.

EXPLANATION OF FIGURES.[6]

PLATE 19.

Figure 1. *Chaetocnema denticulata* (Ill.). Clypeus and labrum.

Figure 2. *Chaetocnema denticulata*. Head, dorsal view. ANT, antenna; ENC, endocarina; EP, epicranium; EPS, epicranial suture; EPS epistomal thickening; FS, frontal suture; MD, mandible.

Figure 3. *Chaetocnema denticulata*. Left antenna. 1AT, first article; 2AT, rudimentary second article; BMB, basal membrane; FS, frontal suture; OC, ocellus; SAP, sensory appendix.

Figure 4. *Chaetocnema pulicaria* Melsh. Mature larva, dorsal view. IAB, first abdominal segment; IXAB, ninth abdominal segment; LAT, laterotergite; PS, prescutum; S, scutum; SCL, scutellum; SPA, spiracular area; S–SCL, scuto-scutellum.

Figure 4A. *Chaetocnema pulicaria*. Body seta.

Figure 4B. *Chaetocnema pulicaria*. Spiracle from typical abdominal segment.

Figure 5. *Chaetocnema denticulata*. Mature larva, dorsal view. Lettering as in Fig. 4.

Figure 5A. *Chaetocnema denticulata*. Body seta.

Figure 5B. *Chaetocnema denticulata*. Spiracle from typical abdominal segment. (Comparison with Fig. 4B will show difference in location of opening in spiracular sclerite in the two species.)

[5] Whereas in *denticulata* the frontal sutures are distinct and easily traced, in *pulicaria* they are vague and can be followed anteriorly only as far as indicated in the figure (Fig. 6). In the latter their clearness is somewhat exaggerated.

[6] With the exception of figures 14 and 15 (from Blunck), and figure 18 (from Newton), the drawings were made by the author.

Figure 6. *Chaetocnema pulicaria.* Head, dorsal view. Lettering as in Fig. 2.

Figure 7. *Chaetocnema denticulata.* Left maxilla, ventral view. CD, cardo; PG, peg-shaped seta of galea; PGR, palpiger; PLP, palpus; ST, stipes.

Figure 8. *Chaetocnema pulicaria.* Right mandible, dorsal view.

Figure 9. *Chaetocnema denticulata.* Right mandible, dorsal view.

Figure 10. *Chaetocnema denticulata.* Right maxilla, dorsal view. GA, galea; LC, lacinia.

Figure 11. *Chaetocnema denticulata.* Head, ventral view. MT + SMT, postmentum; PRMT, prementum.

Figure 12. *Chaetocnema denticulata.* Left metathoracic leg, anterior view. CL, claw; CX, coxa; EPM, epimeron; ES, episternum; FE, femur; PP, paronychial appendix; TR, trochanter; T–TA, tibio-tarsus.

Figure 13. *Chaetocnema pulicaria.* Head, ventral view. Lettering as in Fig. 11.

PLATE 20.

Figure 14. *Chaetocnema aridula* Gyllh.[7] Metathorax and first abdominal segment, showing arrangement of sclerites and setae. ES, episternum; PST, presternum; S, sclerite of scutum; SP, spiracle.

Figure 15. *Chaetocnema aridella* Payk.[7] Mesothorax and first abdominal segment, showing arrangement of sclerites and setae. Lettering as in Fig. 14.

Figure 16. *Chaetocnema denticulata.* Metathorax and first abdominal segment, showing arrangement of sclerites and setae. Lettering as in Fig. 14.

Figure 17. *Chaetocnema pulicaria.* Metathorax and first abdominal segment, showing arrangement of sclerites and setae. Lettering as in Fig. 14.

Figure 18. *Chaetocnema concinna* Marsh.[8] Metathorax and first abdominal segment, showing arrangement of sclerites and setae. Lettering as in Fig. 14.

Figure 19. *Chaetocnema denticulata.* Ninth abdominal segment, dorsal view.

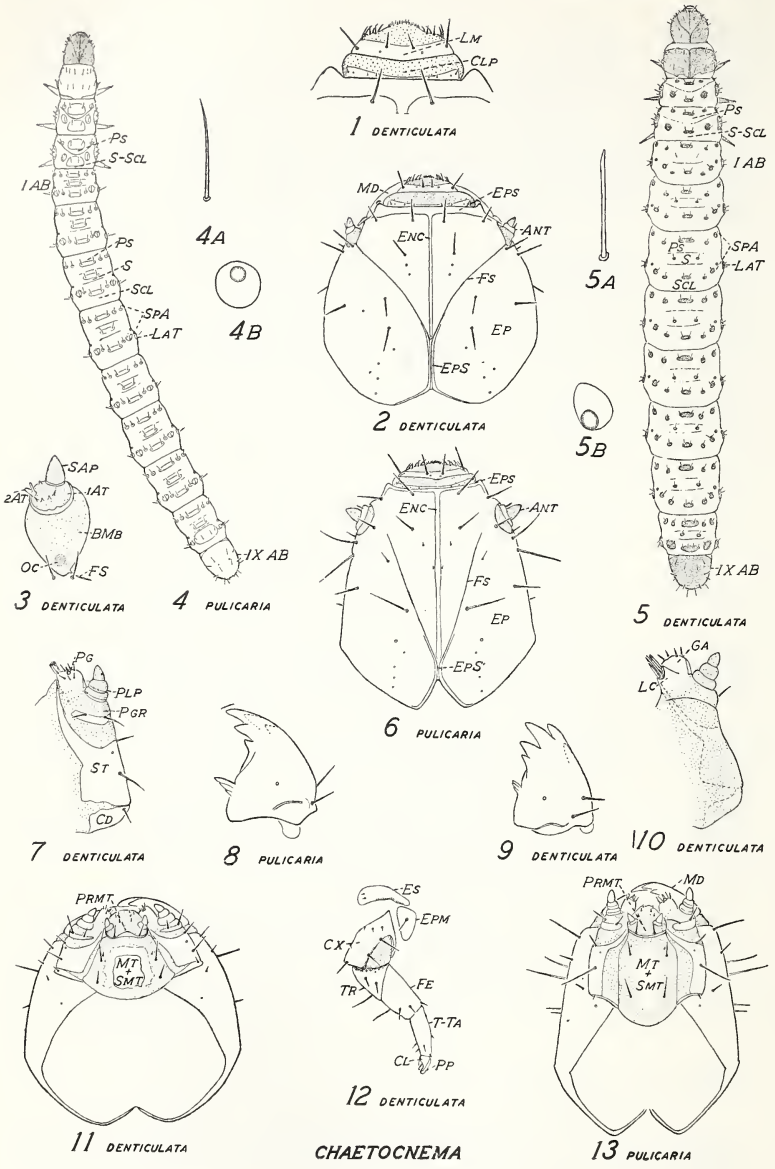
Figure 20. *Chaetocnema pulicaria.* Ninth abdominal segment, dorsal view. UR, urogomphi.

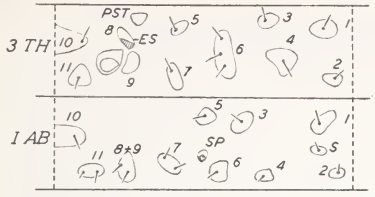
Figure 21. *Chaetocnema denticulata.* End of abdomen, lateral view. XAB, tenth abdominal segment. Remainder of lettering explained in text.

Figure 22. *Chaetocnema pulicaria.* End of abdomen, lateral view. Lettering as in Fig. 21.

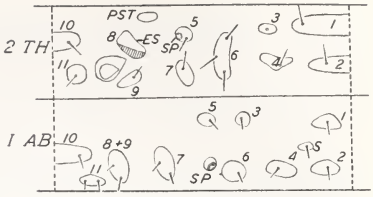
[7] Figures 14 and 15 adapted from Blunck's figures 14b and 14c, respectively. Blunck, Hans. Zur Kenntnis der Lebensgewohnheiten und der Metamorphose Getreidebewohnender Halticinen. Zeit. f. Angewandte Ent., Band 19, pp. 357–394, illus. 1932.

[8] Adapted from Newton's figures 8 and 9. Newton, H. C. F. Observations on the Biology of some Flea-beetles of Economic Importance. Jour. S. E. Agr. Col., Wye, Kent, No. 26, pp. 145–164, illus. July, 1929.

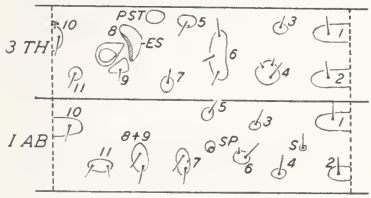

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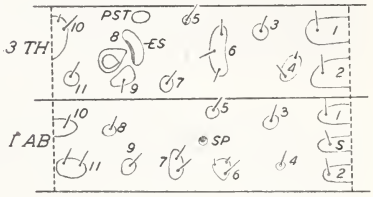
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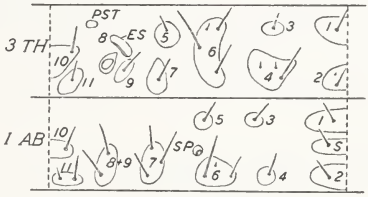
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16 DENTICULATA



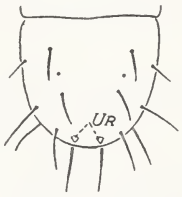
17 PULICARIA



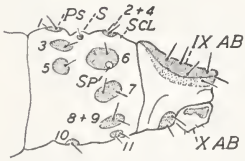
18 CONCINNA



19 DENTICULATA



20 PULICARIA



21 DENTICULATA



22 PULICARIA

CHAETOCNEMA

NEW SPECIES AND SYNONYMY IN THE GENUS MACROCENTRUS (HYMENOPTERA : BRACONIDAE).

By C. F. W. Muesebeck,
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

In my revision of the Nearctic species of *Macrocentrus*[1] I expressed uncertainty concerning the identity of *M. nigridorsis* Viereck and *M. pectoralis* Provancher, not having seen the type of either species. Since that time, however, I have had an opportunity to examine these types. As a consequence it becomes necessary to suppress two names which were treated as valid in the revisionary paper mentioned.

Macrocentrus nigridorsis Viereck.

Macrocentrus nigridorsis Viereck, Can. Ent., Vol. 56, p. 68, 1924.
Macrocentrus harrisi DeGant, Proc. Ent. Soc. Wash., vol. 32, p. 164, 1930. New synonymy.

On pages 19 and 52 of my revision, it was suggested that these two names might prove to apply to the same species. Examination of the type of *nigridorsis*, which is in the Canadian National Collection at Ottawa, shows this to be the case; *harrisi* DeGant, therefore, must be suppressed as a synonym of *nigridorsis* Viereck.

Macrocentrus pectoralis Provancher.

Macrocentrus pectoralis Provancher, Nat. Can., vol. 12, p. 173, 1880.
Macrocentrus fuscipennis Muesebeck, Proc. U. S. Nat. Mus., vol. 80, Art. 23, p. 43, 1932. New synonymy.

It was stated on page 52 of the same paper that, on the basis of the original description and other notes, *pectoralis* appeared to be very similar to *pallisteri* DeGant, and that the two might be found to be identical. They are not, however. Study of the type of *pectoralis* has convinced me that it is the species which I described under the name *fuscipennis*. The latter name, accordingly, is here placed in synonymy.

Reared material of two new species of *Macrocentrus* is at hand, and since names are desired for these they are described below.

Macrocentrus gravitarsis, new species.

In the key contained in the *Macrocentrus* revision mentioned above this runs to couplet 33, and here agrees with the second alternate except for the shorter calcaria of posterior tibia and the absence of the transverse black band on vertex. In its

[1] Proc. U. S. Nat. Mus., vol. 80, Art. 23, pp. 1–55, 1932.

short ovipositor it differs from all other known Nearctic species except *uniformis* Provancher; and from this species, as well as from all others, it is immediately distinguished by its unusually stout tarsi. It is, furthermore, the largest Nearctic species of *Macrocentrus* known.

Female.—Length, about 14 mm. Head strongly transverse, barely wider than thorax; temples and cheeks receding, not convex; eyes very large and prominent, slightly divergent below; malar space as long as basal width of mandible; clypeus more than half as long as width of its apical truncature; ocellocular line barely longer than diameter of a lateral ocellus; maxillary palpus long, its longest segment about as long as first segment of antennal flagellum; antennae longer than body, 55-segmented in the type.

Thorax short, smooth, and shining; middle lobe of mesoscutum prominent; scutellum strongly convex; metanotum long, with a sharp median longitudinal carina; propodeum weakly irregularly transversely aciculate; mesopleurum and metapleurum smooth and shining; metapleural tooth large and prominent, acute; posterior coxa very long; calcaria of posterior tibia stout, the longer one not more than half as long as metatarsus; all tarsi unusually stout; fourth segment of posterior tarsus about as broad as long; forewing large, broad; stigma elongate, emitting radius much beyond its middle; radial cell nearly attaining apex of wing; first cubital cell very large, its extreme length about that of first discoidal; second abscissa of cubitus as long as recurrent; submedian cell glabrous, its apical third abruptly widened; nervulus only slightly postfurcal; mediella considerably more than twice as long as lower abscissa of basella, which is not distinctly as long as nervellus; radiellan cell slightly narrowed at end of basal fourth but gradually broadening from that point to apex.

Abdomen much longer than head and thorax combined, compressed apically; first tergite more than three times as long as broad at apex, not at all impressed at base, very weakly irregularly sculptured on middle third; spiracles of first tergite about at end of basal third, much farther from base of segment than from each other; second abdominal tergite considerably longer than broad, distinctly separated from third, with a little weak longitudinal sculpture on basal half; third tergite slightly longer than broad; ovipositor sheath thickly covered with long hair and not longer than apical truncature of abdomen.

Reddish yellow; antennae yellowish; legs reddish yellow; wings faintly tinted with yellow, stigma deep yellow, veins brown.

Type.—U. S. Nat. Mus. No. 51915.

Type locality.—Berkeley, California.

Three female specimens: The type reared from *Halisidota argentata* Pack, by W. H. Lange; one paratype reared July 17, 1916, by Carl Heinrich, from *Euschausia ingens* (Hy. Edw.), taken on *Pinus contorta* in Gila National Forest, Mogollon, New Mexico, elevation 7200 ft.; and a second paratype from Michigan Bluff, Placer Co., California. The last-mentioned specimen is the property of the California Academy of Sciences and has been returned to that institution.

Macrocentrus infumatuus, new species.

This belongs among the group of gregarious species which have the submedian cell completely closely hairy and the scutellum short. In its completely rugose metapleura it resembles *terminalis* (Ashm.) but it differs widely in color, as well as in having the mesopleura smooth, the mandibles unusually short, and the basal abdominal tergites more coarsely sculptured. It can be immediately distinguished from all other North American species of this group by its strongly infumated wings and the black tibiae and tarsi of all the legs.

Male.—Length, 4.5 mm. Face gently convex, much broader than eye height, finely but distinctly punctate; malar space shorter than clypeus; temples and cheeks receding strongly; ocellocular line nearly twice as long as the diameter of an ocellus; maxillary palpus as long as width of head, but labial palpus barely as long as face. Mandibles very short, not meeting at tips, and with the teeth unusually short, the outer tooth barely surpassing the inner one. Antenna 40- to 42-segmented, longer than the body, the second segment much longer than the longest segment of labial palpus.

Thorax a little narrower than head; notaulices foveolate, meeting in a punctate groove which extends to apex of scutum; scutellum small, flat, much less than half as long as propodeum; propodeum and metapleurum completely rugose; mesopleurum polished; prepectus smooth; legs very slender; wings narrow; submedian cell completely closely hairy; nervulus postfurcal by less than half its length; radial cell short, ending much before apex of wing; radius from slightly beyond middle of stigma, its first abscissa usually a little longer than second; second abscissa of cubitus very short; mediella about twice as long as lower abscissa of basella, the latter much longer than nervellus.

Abdomen narrow; first tergite closely longitudinally rugulose, with a conspicuous impression at extreme base; second tergite slightly longer than broad, longitudinally striate; third tergite aciculate on basal half.

Black; head black, including antennae; palpi piceous; thorax black except the mesopleura and mesosternum, which are honey yellow; mesoscutum sometimes with small reddish markings; all coxae and trochanters, and the femora except for blackish apices, concolorous with mesopleura; all tibiae and tarsi entirely black; wings conspicuously fuscous; stigma and veins dark brown, the former with a small pale spot at base; abdomen black above and below.

Type.—U. S. Nat. Mus. No. 52850.
Type locality.—Douglas Lake, Cheboygan Co., Mich.
Host.—Probably *Schoenobius melinellus* (Clem.).
Described from 4 male specimens reared by W. Carrington Frohne in July and August, 1936.

MINUTES OF THE 492ND REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 492nd meeting of the Society was called to order by President Back at 8 P. M., Thursday, May 5, 1938, in Room 43 of the National Museum, with 47 members and 11 visitors present. The minutes of the previous meeting were read and approved.

H. S. McConnell presented the name of Charles S. Wilson, Division of Insects Affecting Man and Animals, Bureau of Entomology and Plant Quarantine, Washington, D. C., who, being recommended by the Executive Committee, was elected to membership in the Society.

President Back announced the deaths of Dr. Maurice C. Hall and Mr. Warren Knaus, both members of the Society. J. S. Wade and E. A. Chapin were appointed to prepare an obituary of Dr. Hall, and H. S. Barber and W. S. Fisher were similarly appointed to draw up an obituary of Mr. Knaus.

President Back reported that the Executive Committee had recently decided to consider the publication by the Society of larger scientific papers than those now appearing in the Proceedings. A committee appointed by the President, consisting of C. F. W. Muesebeck, Chairman, W. R. Walton, R. A. Cushman, H. E. Ewing and D. J. Caffrey, met and made the following recommendations, which were approved by the Executive Committee:

1. That our Society establish a publication series to be known as the Memoirs of the Entomological Society of Washington, publications in this series to be issued irregulary as conditions permit.

2. That the Memoirs shall be financed entirely out of the publication funds of the Society according to the provisions of the constitution and the restrictions placed on such funds by their donors, and that the money obtained from the sale of these Memoirs be returned to a fund which shall be used for publication of future numbers of the Memoirs.

It was suggested by the President that the matter be fully discussed at the June meeting.

Under notes and Exhibition of Specimens, A. B. Gurney briefly discussed an important paper by Dr. E. M. Walker, entitled "Grylloblatta, a living fossil" (Proc. and Trans. Roy. Soc. Canada, ser. 3, sect. 5, v. 31, pp. 1–10, 1937). The paper is not primarily taxonomic, but brings together in a concise manner the more important facts concerning the Grylloblattidae. In addition to summarizing previous knowledge, some new information is included, especially regarding biology. (Author's abstract.)

The regular program consisted of a symposium on cereal and forage insects. The first speaker, C. M. Packard, spoke on "The work of the Division of Cereal and Forage Insect Investigations."

> [Annual value of these crops is 5 to 8 billion dollars with annual loss due to insects estimated about 500 to 800 million dollars. Low acre values limit control measures mostly to low-cost cultural type and increase difficulty of finding practical ones. About 75 research men now employed by Division on these insects, at 24 stations in all parts of the United States, on many different insects and crops, including grasshoppers, Mormon crickets, chinch bug, corn earworm, corn borers, sugarcane borer and insect vectors of sugarcane mosaic, white grubs, wireworms, hessian

fly, jointworms and sawflies, greenbug and other aphids, cutworms and army worms, stink bugs attacking rice, plant bugs and other insects injuring alfalfa seed, leafhoppers as pests of legumes, flea beetles as vectors of corn wilt, and many insect pests of stored grains and grain products. Accomplishments recently completed or in progress are cheaper baits for grasshopper control; successful sprays for corn borer control in early market sweet corn and dahlias; ear fumigation and oil spray for earworm in sweet corn; varieties of wheat resistant to hessian fly, alfalfa resistant to pea aphid, and corn resistant to corn borer; early cutting for alfalfa weevil; cultural practices and sprays for plant bugs attacking alfalfa seed crop; control of leafhoppers on peanuts by spraying; and improvements in fumigation for control of stored grain and mill insects.] (Author's abstract.)

The second speaker, George W. Barber, gave an illustrated talk, entitled "New developments in Corn Earworm control."

[Control of the corn ear worm (*Heliothis obsoleta* F.) has unusual difficulties in that to protect a given ear of corn not a single larva can be permitted to enter it. Exploration of possible means of protecting ears showed that this could be accomplished by placing a barrier at the ear tip, through which larvae could not penetrate. It was necessary to protect the ears against every larva, but to do this at a cost that growers could afford to expend, and by means which would not injure the appearance of the ears or affect in any way their use by consumers. The desired results were obtained by two means, fumigation and oiling.

[In fumigation a pressed tablet of hexachlorethane containing .5 gram of the material was inserted into the ear just after fertilization had been accomplished. A wire clip was then placed about the tip of the ear above the fumigant to retain the evaporating gas. Larvae were killed as they tried to penetrate through the barrier of gas thus formed. This control has given more than 90 per cent of uninfested ears at harvest, at a cost of about 3 cents per dozen ears.

[A less expensive control consists of applying light mineral oil of viscosity between 100 and 200 Saybolt to tips of ears just after fertilization. Application at a rate of about 1 cc., per ear, at a cost of not more than 1 cent per dozen ears, protected up to 79 per cent.

[Both these control measures have valuable features such as: a single treatment per ear, effectiveness in any weather conditions, no change in appearance or in flavor of ears, effectiveness under any populations of the insect, and no danger to consumers of roasting ears.] (Author's abstract.)

This paper was discussed by Muesebeck and Back.

The program was concluded by a motion picture, entitled "The Long-Winged Grasshopper and control operations" which was introduced by W. R. Walton. The picture was especially concerned with *Dissosteira longipennis* (Thomas), which in 1937 was exceedingly abundant and destructive in Colorado and other Western States.

Adjournment at 9.40 P. M.

ASHLEY B. GURNEY,
Recording Secretary.

Actual date of publication, June 24, 1938.

ANNOUNCEMENT

Prices for back volumes and single numbers of the Proceedings of the Entomological Society of Washington are as follows, until further notice:

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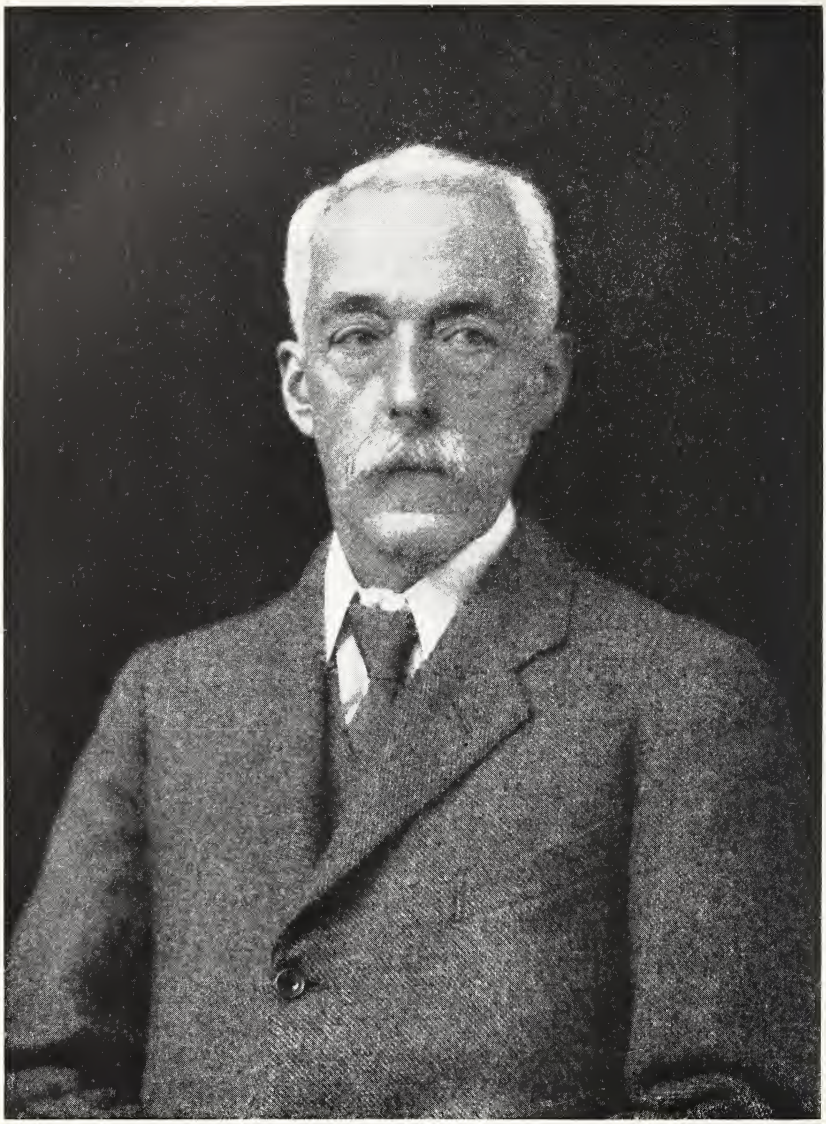
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EDWARD MEYRICK, F. R. S.

PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 40 OCTOBER, 1938 No. 7

EDWARD MEYRICK, F. R. S.
1854–1938.

The Nestor and central figure among Microlepidopterists in the past fifty years, Edward Meyrick, of "Thornhanger," Marlborough, England, died March 31 of this year after a short illness. His death leaves a void which it is difficult for his numerous students and correspondents all over the world to realize. For fifty years we have sought his help, always so generously extended. When we did not know, we asked Meyrick and we were sure of a prompt and authentic solution of our problem.

Edward Meyrick was born in Wiltshire, England, and here he lived all his life with the exception of ten years (1877–1886), which he spent as schoolmaster in Australia and New Zealand.

His father, grandfather and great grandfather were vicars in the neighboring village of Ramsburg, where Meyrick was born and where he is buried. He had a classical education in Marlborough College and in Trinity College in Cambridge. On his return from Australia he became Master of Marlborough College and President of the Marlborough Natural History Society, and remained as such until he retired in 1914. His arduous work as a strict but beloved teacher is pleasingly mentioned by the Director of Kew, Sir Arthur Hill, in the school magazine, "The Marlburian" for May, 1938. It is interesting to note that the classics, Latin and Greek, were Meyrick's vocation, while Natural Sciences and particularly Systematic Entomology, by which he won world fame, was an avocation, until his school work ended.

Though interested in Lepidoptera long before he went to Australia, the wealth of new forms he encountered there and from which he collected eagerly, gave him the impetus for his astonishing work, which covered the entire globe and made him the authority for students in all parts of the world. His prodigious work covers Australia, New Zealand, America, Asia, Europe, Africa and the South Pacific Islands.

T. Bainbrigge Fletcher estimates that Meyrick described some 20,000 new species of Lepidoptera besides hundreds of new genera and several families; double that number is probably nearer the truth. His numerous descriptions were published in

various entomological journals for many years, but when he gave up his school work in 1914 and was able to devote his entire time to entomology he found it necessary in addition to issue his own publication, "Exotic Microlepidoptera," which he described as "a spasmodic Entomological Magazine on one subject by a single contributor." Of this, four volumes and part of a fifth appeared, covering 2722 pages with an average of 3 descriptions of new species per page, besides definitions of numerous new genera and families. Some conception of Meyrick's astonishing productivity is gained when it is considered that he at the same time continued to contribute lengthy descriptive papers to various journals with other thousands of new species, and yet found time to do the laborious revisional work necessary for his many volumes contributed to Wagner's "Lepidopterorum Catalogus" and Wytzman's "Genera Insectorum."

Meyrick's "Handbook British Lepidoptera" 1895 and the revised edition (1928) is probably his best known work; in it he broke away radically from the older classifications and established his system with the wing venation as principal character for the separation of families and genera. It created a storm of protest among the leading entomologists of the day and adverse reviews of the book were numerous, but the system still remains and will remain fundamentally sound though subject to modifications by the study of the genitalia and early stages of Lepidoptera, to which Meyrick paid scant attention.

Meyrick's extensive and intimate knowledge of the Microlepidoptera of the world led his active and logical thinking to daring conclusions about their origin and their geographical distribution, involving original speculations on prehistoric land connections between now isolated continents. A classical example is his description and naming of the large South Pacific archipelago *Palaeonesia*, now submerged 12,000 feet and represented only by a few small islands thousands of miles aprat; and it is very characteristic of Meyrick that this new name and description was published in a paper (Trans. Ent. Soc. London, p. 490, 1928) in which on the next page he named and described a new little moth with an alar expanse of 10 mm.

It was a great privilege to know Mr. Meyrick either as a correspondent or a guest in his hospitable home, "Thornhanger," which became a Mecca for entomolgists from all parts of the world. The name of this Mecca was rather significant of the man, who till his death retained something of the stern schoolmaster. He could be sharp enough in his conversation or in his replies to correspondents if his opinions were questioned without, what he considered, sufficient grounds, but when you came to know him well, either by letters or by personal contact, you found him, especially in his later years, a most charming, genial

personality and personal friend, always ready to discuss differences of opinion and to share liberally his immense fund of knowledge as well as any specimens he could spare.

Meyrick's exceedingly valuable collection, consisting of more than 100,000 specimens, including the great majority of his tens of thousands of types, was given by him to the British Museum of Natural History. A few of his types, and more than a thousand paratypes and other authentic specimens determined by him, are in the U. S. National Museum, and others are in the Berlin and Vienna Museums.

Our friend is gone and his many younger coworkers, who for years have depended on his encouraging help in their studies, will sorely miss him, but his monumental work will remain a sound foundation for further work with the Microlepidoptera.

AUGUST BUSCK,
By order of the Society.



THORNHANGER

NORTH AMERICAN MITES OF THE SUBFAMILY MYOBIINAE, NEW SUBFAMILY (ARACHNIDA).

By H. E. Ewing,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

This paper deals with a group of degenerate, parasitic mites that have for over a century been included in the genus *Myobia* Heyden (1826). They are peculiar arachnids, adapted for a parasitic life in the fur of certain mammals by having the front legs greatly shortened and transformed into hair claspers, and the palpi reduced to small hook-bearing cones. These degenerate mites feed at the bases of the hairs on the secretions in the hair-follicles, seldom, if ever, sucking blood. Members of this group have a restricted range in their host distribution, being found only on mammals of three orders,—Rodentia, Insectivora, and Chiroptera. Their absence from other mammalian groups gives rise to certain theoretical speculations, concerning which the present writer will have some facts to present at a later date.

Although greatly modified by adaptation, the structure of these mites shows clearly that they belong to the family Cheyletidae, a group composed chiefly of free-living species. In this paper the genus *Myobia* Heyden is divided into four genera which are grouped together under the new subfamily name Myobiinae.

Subfamily Myobiinae, new subfamily.

Body flattened; skin soft, with little or no pigment. Eyes absent. Mouth parts greatly reduced; palpi minute to vestigial, typically two-segmented; chelicerae needlelike, thrust from apex of small, conelike capitulum during the process of feeding. Leg I greatly modified for hair clasping; segments I and II very stout, short; segment III bearing a large, clawlike, clasping tubercle; segments IV and V usually anchylosed with segment III, but distinct in one genus. Tarsi of legs II, III and IV provided with either one or two claws. Males smaller than females, with fewer and differently shaped and differently arranged dorsal setae. Penis internal, sclerotized.

Type genus.—Myobia Heyden (1826).

The family Cheyletidae is in need of a thorough taxonomic overhauling. That its elements constitute a harmonious phylogenetic unit appears probable, yet such wide diversity in habits and structure exists between species of certain of the included genera as to make evident the need for subgroups within the family. Such genera as *Syringophilus* Heller and *Sarcopterinus* Railliet, composed of parasitic species, should never be put in the same subfamily with genera composed of free-living cheyletids. A start is here made toward breaking up the family into subfamilies by erecting a new one for the aberrant *Myobia* and its generic derivatives.

Generic characters in the Myobiinae.

Characters recognized as good generic ones in nearly all families of the Acarina have been mentioned by some acarologists in dealing with *Myobia*, but usually they have been overlooked. Even descriptions of many species contain few if any references to them. Basically the most important character, yet the hardest to interpret, is the variation in the number of segments in the modified first pair of legs. Of almost equal importance is the presence of either one or two claws on each tarsus of the last three pairs of legs.

A careful study of the American species of *Myobia* shows that the number of segments in leg I ranges from three to five. This does not take into account the coxa, which is never a freely movable segment in any of the legs, and may not always be in evidence.

Tarsus II of the type species of *Myobia*, *M. musculi* (Schrank), is armed with a single claw. Yet in several of the described species, such as *M. claparedei* Poppe, this tarsus is armed with two claws. The two claws of tarsus II may be equal or unequal in size, similar or dissimilar in structure, such variations furnishing excellent specific characters.

Tarsi III and IV, like tarsus II, may each be furnished with either one or two claws. In some species one of the two claws of tarsus III or IV is so small that these tarsi may, by mistake, be regarded as single clawed.

Specific characters in the Myobiinae.

The chaetotaxy of the dorsal surface of the body (see Fig. 1) has been used not only as the chief specific character in this group of parasitic mites, but by some workers almost exclusively. In the females of all species and in the males of most species the dorsal setae, with the exception of a few minute ones near the tip of the abdomen, are arranged in somewhat irregular transverse and longitudinal rows. Of the former there are six, to which Radford (1934) has applied the terms series I, series II, series III, etc.; of the latter there are four, two submedian and two lateral. In the present paper each dorsal seta is named according to its position in a longitudinal row. Thus the first seta in a submedian row is called submedian I; the second in the same row, submedian II, and so on. The first seta in a lateral row is called lateral I; the second in the same row, lateral II, and so on throughout the row. In the males of certain species a single median seta may supplant either submedians III, IV or V. The median setae are known according to their position in the row as median I, median II, or median III.

Positive identification of the dorsal setae in certain species is rather difficult where several are missing, and where those present occupy rather unusual positions. However, if a few

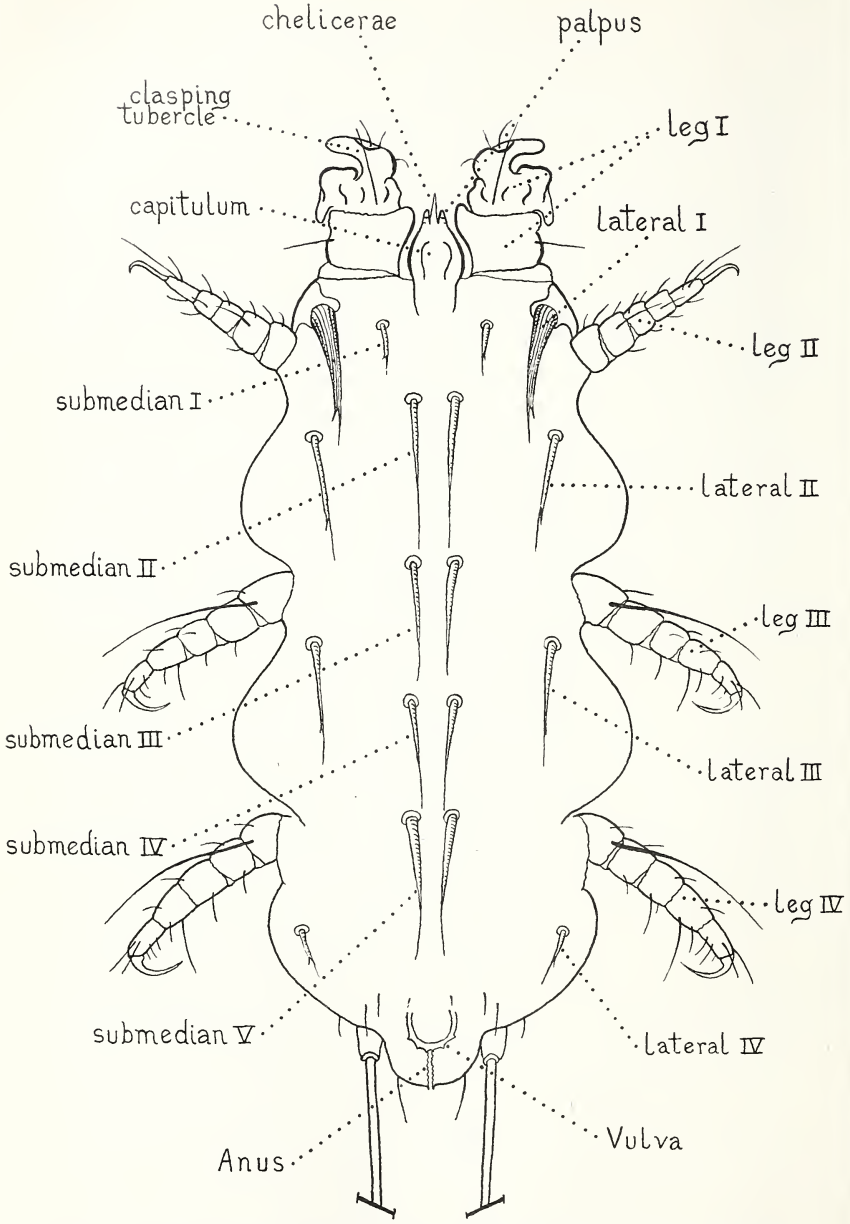


Fig. 1.—Dorsal view of *Myobia musculi* (Schrank) with parts labeled. Greatly enlarged. In labeling the dorsal setae the word seta has been omitted.

facts in regard to their general arrangement and the common types of variation are kept in mind, the dorsal setae usually can be properly identified. Of all the dorsal setae, lateral I (see Fig. 1) probably is the most easily recognized, since it is invariably present and usually is very large. It is situated at or near the base of leg I. The submedians III, IV, and V are peculiar in that they frequently are very similar to each other, yet different from all of the other setae. Sometimes these three pairs of setae are peglike, sometimes spinelike, and sometimes foliaceous. Submedian I is frequently minute; lateral IV (see Fig. 1) is usually missing; and finally submedian VI and lateral VI, if present, usually are not large enough or in a proper position to be identified.

Among the other characters of specific importance are the length and shape of the tarsal claws, the shape of the clasping tubercle of leg I (see Fig. 1), the position and length of the terminal abdominal setae, the shape of the penis, the position of the genital opening in the male, the chaetotaxy of the nymphs, and the size, segmentation, shape, and armature of legs III and IV in both the protonymph and deutonymph.

KEY TO THE GENERA OF MYOBIINAE.

A. Leg I composed of five distinct segments and bearing distally a tarsal claw; tarsus II with two claws ..... *Protomyobia*, new genus.

AA. Leg I composed of three or four segments and without tarsal claw; tarsus II with one or two claws.

B. Tarsus II with two claws.

C. Legs of first pair equal; capitulum symmetrical ..... *Radfordia*, new genus.

CC. Legs of first pair unequal, one being dwarfed; capitulum asymmetrical ..... *Amorphacarus*, new genus.

BB. Tarsus II with one claw ..... *Myobia* Heyden.

Genus **PROTOMYOBIA**, new genus.

Legs of the first pair equal, each composed of five segments; segment I unmodified; segment II with lateral tubercle; segment III swollen, with lateral, hooklike tubercle; segment IV much broader than long; segment V smallest, with apical tubercle terminating in a minute claw. Leg II unmodified, armed with two claws. Legs III and IV each armed with a single claw. None of dorsal setae peglike or foliaceous.

Type species.—*Myobia claparèdei* Poppe.

Remarks.—In *Protomyobia* the legs of the first pair not only retain five distinct segments, but distally there is a minute claw, which must represent the tarsal claw. By studying the series of species of Myobiinae represented in our North American fauna it is easily observed how the number of segments in leg I has been reduced from five to three. The two small distal segments (IV and V) as represented in leg I in *Protomyobia*

become greatly shortened and anchylosed in *Myobia elongata* Poppe (made the type of a new genus in this paper), although in this species segments III and IV are distinct. In some species of *Myobia* (*sensu stricto*) the fused segments IV and V become flattened and disclike, IV being anchylosed with III so as to form a thumb in apposition to the clasping tubercle. Finally in a species of *Radfordia*, described in this paper as *R. inaequalis*, new species, this thumb disappears.

Protomyobia includes only the type species among the North American representatives of Myobiinae. Probably a restudy of certain Old World species would show that other species belong to the genus.

Protomyobia claparedei (Poppe).

Myobia clapar`dei Poppe, Zool. Anz., Bd. XIX, s. 342, figs. 15, 16, 17, 1896.
Myobia clapar`dei Vitzthum, Die Tierwelt Mitteleuropas, Bd. III, Lief. VII, s. 56, 1929.
Myobia clapar`dei Radford, North Western Nat., 1935, p. 250, figs. 6, 7, 8, 1935.

Female.—Leg I stout, extending beyond tip of palpus by one-third its length; first free segment, or trochanter, broader than long; segment II twice as broad as long, with ventrolateral, striated tubercle; segment III equal to segment I in width, armed ventrolaterally with curved, striated clasping tubercle and ventromedially with spinelike tubercle; segment IV twice as broad as long and armed ventrally with conspicuous, striated, spinelike tubercle; segment V very small, broader than long, armed distally with sharp, curved claw. Claws of tarsus II unequal, posterior being only about one-half as long as anterior, less curved and provided with ventral tooth. Tarsus III and IV each provided with a single, long, curved claw. Dorsal setae as follows: Submedian I minute, in usual position; submedian II minute, situated more posteriorly than lateral II; submedians III–V subequal, each flattened for about its basal half; laterals I–III very long, subequal, each slightly flattened basically; laterals IV–VI absent. Outer pair of posterior marginal setae as long as body, situated on tubercles; inner pair of posterior marginal setae minute, each situated more than its length from anal slit.

Length of female, 0.47 mm., width, 0.32 mm.

Male.—Leg I as in female. Tarsal claws as in female except that tooth on posterior claw of tarsus II is vestigial. Dorsal setae as follows: Submedian I very minute, situated close to median line; submedian II absent; submedian III minute, situated near but posterior to lateral III; submedians IV and V very small, situated near each other and slightly posterior to genital opening; laterals as in female except that lateral III is somewhat longer. Genital opening at middle of dorsum, unaccompanied with sclerotizations. Penis stout, pigmented, sinuous, about one-third as long as body, blunt at apex.

Length of male, 0.35 mm.; width, 0.22 mm.

Type host.—*Sorex vulgaris*, now *S. araneus*.
Type locality.—Central Europe.

Types.—Located?

Remarks.—Described from five females and one male taken from *Blarina brevicauda* captured along the Northwest Branch of Anacostia River, near Washington, March 29, 1932, by Ray Greenfield; three females taken from *Sorex fumeus*, Ossipee, New Hampshire, July 20, 1927, by Francis Harper (No. 511); and one male taken from "little short-tailed shrew," Wilmington, North Carolina, April 1, 1933, by H. S. Peters (Bishopp No. 20739).

Genus **RADFORDIA**, new genus.

Legs of the first pair equal, each composed of three or four visible segments; segment I unmodified; segment II either unmodified or with one or two ventral tubercles; segment III with powerful, hook-like, clasping tubercle; segment IV always anchylosed with segment V and sometimes with III also; segment V usually bearing a claw in form of spinelike process. Tarsus II with two claws; tarsi III and IV each with either one or two claws. Some of dorsal setae inflated or subfoliaceous.

Type species.—*Myobia ensifera* Poppe.

Besides the type species this genus includes *Myobia lemnina* Koch, *M. affinis* Poppe, *M. chiropteralis* Michael, *M. ingens* Vitzthum, *M. ewingi* Fox, *M. trouessarti* Poppe, *M. rollinati* Poppe, and three new species described in this paper. Doubtless a restudy of other described species will show that some of them belong in this new genus.

Key to the North American Species of Radfordia.

A. Claws of tarsus II equal.
  B. Submedian seta I of female large, inflated, overreaching submedian II..... *R. lemnina* (Koch).
  BB. Submedian seta I of female never reaching beyond one-half the distance to submedian II.
    C. Submedian seta I of female with lateral spur; tarsus II of female longer than broad. On a harvest mouse.. *R. subuliger*, new species.
    CC. Submedian seta I of female simple, without spur.
      D. Submedian setae III to V of usual setiform shape..... *R. floridensis*, new species.
      DD. Submedian setae III to V much broadened and flattened, with margins subparallel..... *R. ensifera* (Poppe).

AA. Claws of tarsus II unequal.
  B. Tarsi III and IV of female each provided with two unequal claws. Parasitic on a bat..... *R. inaequalis*, new species.
  BB. Tarsi III and IV of female each provided with a single claw.

C. Posterior claw of tarsus II about as stout as anterior; penis spinelike, scarcely reaching to level of coxae II. On house mouse..... *R. affinis* (Poppe).

CC. Posterior claw of tarsus II much more slender than anterior; penis very slender, flagelliform, reaching to level of coxae II. On jumping mouse..*R. ewingi* (Fox).

Radfordia lemnina (Koch).

Dermaleichus lemninus C. L. Koch, Deu. Crust. Myr. Arachn., fasc. 33, t. 5, 1841.

Myobia lemnina Poppe, Zool. Anz., Bd. XIX, s. 332, fig. 4, 5, 6, 1896.

Myobia lemnina Vitzthum, Die Tierwelt Mitteleuropas, Bd. III, Lief. VII, s. 56, 1929.

Myobia lemnina Radford, North Western Nat., 1935, p. 251, figs. 9, 10, 11, 1935.

Female.—Leg I stout, extending beyond tips of palpi by about one-third its length; first movable segment with heavy, recurved, hooklike, ventrolateral tubercle; segment II with two ventral and one inner tubercles; segment III with outwardly directed, transversely striated, hooklike clasping tubercle and flattened, striated, disclike thumb bearing a straight, stout spine. Claws of tarsus II equal, toothless. Tarsus III with a single, curved, toothless claw. Tarsus IV with a single claw, subequal to that of tarsus III. Dorsal setae as follows: Submedian I large, striated, with lateral barb, extending beyond base of submedian II; submedian II similar to submedian I but longer; submedians III–V subequal, each much smaller than submedian II and without barb; lateral I largest of all dorsal setae, striated, with lateral barb, extending slightly beyond base of lateral II; lateral II similar to lateral I but somewhat smaller; lateral III subequal to lateral II; lateral IV similar to lateral III but slightly smaller; lateral V small, without barb. Outer pair of posterior marginal bristles flagelliform, fully as long as body; inner pair of posterior marginal bristles very small, each situated its length from anal slit.

Length of female, 0.41 mm.; width, 0.24 mm.

Male.—Leg I as in female. Tarsal claws as in female. Dorsal setae as follows: Submedian I small, without lateral barb, situated more than its length from lateral I; submedian II about twice as long as submedian I, greatly displaced laterally, being very near and anterior to lateral II; submedians III–V absent, their place being taken by two long, unbarbed median setae; median I absent; median II situated slightly posterior to level of lateral III and submedian III situated at level of coxae IV. Genital opening situated above base of mouth parts; penis slender, almost straight, slightly pigmented and about one-third as long as body.

Length of male, 0.32 mm.; width, 0.19 mm.

Type host.—*Lemmus arvalis*, now *Clethrionomys glareolus*.

Type locality.—Germany.

Types.—Located?

Remarks.—Described from three females and one male taken from *Microtus pennsylvanicus* (C. P. 43) at College Park, Maryland, April 6, 1932, by Ray Greenfield. The presence of

two large median setae (medians II and III) on the dorsum of the male easily identifies this species.

Radfordia subuliger, new species.

Female.—Leg I stout; segment I without tubercles; segment II with a small, ventral, spinelike tubercle situated near its middle and a much larger, flattened, broadly-forked tubercle situated on inner ventral aspect; segment III with large, lateral, longitudinally-striated, hooklike process and strongly hooked, terminal, clasping tubercle. Claws of tarsus II equal, toothless. Tarsi III and IV each with a single, slender, slightly curved, toothless claw. Dorsal setae as follows: Submedian I very small, with lateral barb, reaching scarcely one-half the distance to base of submedian II; submedian II large, obliquely striated, with lateral barb, extending to base of submedian III; submedians III–V subequal, each long and obliquely striated but without barb; lateral I much the largest of all the dorsal setae, longitudinally striated, with conspicuous barb; lateral II subequal to submedian II; lateral III like submedian II but slightly smaller; lateral IV absent. Outer pair of posterior marginal setae about as long as the body, situated on tubercles; inner pair of marginal setae situated about three-fourths their length from anal slit. Femur II, trochanter III, and trochanter IV, each bears a very long, whiplike seta on its dorsal side.

Length of female, 0.45 mm.; width, 0.23 mm.

Male.—Unknown.

Type host.—Small-eared harvest mouse, *Reithrodontomys humulis impiger*.

Type locality.—College Park, Maryland.

Type slide.—U. S. National Museum No. 1280.

Described from two females taken on type host from type locality, April 6, 1932, Ray Greenfield collector; and from one female taken from southern golden mouse, *Peromyscus nuttalli aureolus*, Wilmington, North Carolina, April 1, 1933, by H. S. Peters. This species is nearest *R. lemnina* (Koch), but females differ from those of Koch's species in having submedian seta I only about half as long and in the absence of lateral seta IV.

Radfordia floridensis, new species.

Female.—Leg I very short and stout; segment I broader than long, broadest segment; segment II as broad as long, with ventral, recurved, spinelike tubercle; segment III anchylosed with IV, bearing strongly curved, outwardly directed, clasping tubercle and flattened, striated, spine-bearing thumb. Claws of tarsus II equal, toothless. Tarsi III and IV each with a single, toothless, strongly curved claw. Dorsal setae as follows: Submedian I simple, without spur, not reaching base of submedian II; submedian II long, setiform, extending beyond base of submedian III; submedians III to V setiform, long, simple, subequal; lateral I large, spinelike, without barb or striations, extending slightly beyond base of lateral II; laterals II and III long, simple, setiform, in usual positions; lateral IV absent. Outer pair of posterior marginal setae broken off; inner pair

of posterior marginal setae minute. Femur II, trochanter III, and trochanter IV each bearing a long, tactile dorsal seta.

Length of female, 0.43 mm.; width, 0.28 mm.

Male.—Unknown.

Type host.—Free-tailed bat, *Tadarida cynocephala.*

Type locality.—Leon County, Florida.

Type slide.—U. S. National Museum No. 1281.

Remarks.—Described from a single female taken from type host at type locality, August 27, 1934, by E. V. Komarek (Bishopp No. 22334). This species is particularly characterized by having all the dorsal setae setiform and simple (without barb or striations).

Radfordia ensifera (Poppe).

Myobia ensifera Poppe, Zool. Anz., Bd. XIX, s. 341, figs. 12–14, 1896.

Myobia ensifera Fahrenholz, Abh. Nat. Ver., Bremen, Bd. XIX, Heft 3, Taf. XVI, XVII, 1909.

Myobia ensifera Vitzthum, Die Tierwelt Mitteleuropas, Bd. III, Lief. VII, s. 56, 1929.

Myobia ratti Skidmore, Can. Ent., Vol. LXVI, p. 112, 1 fig., 1934.

Myobia ensifera Radford, North Western Nat., p. 358, figs. 7, 8, 9, 1934.

Female.—Leg I with first segment broader than long; segment II slightly broader than long, with ventrolateral tubercle; segment III composed of completely fused segments III to V, bearing the outwardly directed, clawlike, clasping tubercle and the broad flattened thumb (fused segments IV and V), with its apical, blunt-pointed spine. Claws of tarsus II equal, toothless. Tarsi III and IV each bearing a single, long, curved, toothless claw. Dorsal setae as follows: Submedian I extending to base of submedian II, with lateral barb; submedian II very long, extending slightly beyond base of submedian III, with minute lateral barb; submedians III to V broad, flattened into blades, subequal; lateral I very stout, with lateral barb, and longitudinally striated; lateral II slender, slightly longer than lateral I, with barb; lateral III similar to lateral II but smaller; lateral IV absent. Outer pair of posterior marginal setae longer than body; inner pair of posterior marginal setae situated about their length from anal slit.

Length of female, 0.31 mm.; width, 0.19 mm.

Male.—Not observed by the writer. According to the original description and figure by Poppe (1896) the male has no bladelike dorsal setae and the penis is straight, rodlike, and about two-fifths as long as the body.

Length of male, 0.27 mm.; width, 0.17 mm. (according to Poppe).

Type host.—*Mus decumanus*, now *Rattus norvegicus.*

Type locality.—Europe.

Types.—Location unknown.

Description based upon a female sent to the writer by Skidmore (1934), being a part of the material upon which the

description of *Myobia ratti* Skidmore was based. In view of the difficulty which both the present writer and Skidmore have had in trying properly to identify the material which the latter obtained from the white form of *Rattus norvegicus* in Nebraska, it should here be stated that the figures given of this species by Poppe (1896) and by Radford (1934), are decidedly different in certain respects. Poppe shows lateral seta I of the female with a barb and extending to the base of lateral II; while Radford figures lateral I of the female barbless and extending only about half way to base of lateral II. Poppe illustrates submedians III to V of female as being much longer than shown by Radford and as being sharp-pointed at their tips. In regard to the characters here mentioned, the single female which the present writer has, agrees more with Poppe's figures than with those of Radford.

Radfordia inaequalis, new species.

Female.—First segment of leg I broader than long, without ventral tubercle; segment II broader than long and armed apically with a large, curved, striated, ventrolateral tubercle; segment III bearing short, stout, clawlike, clasping tubercle, but no flattened, spine-bearing thumb, the latter being represented by swollen terminal portion of the segment. Tarsi II, III, and IV each armed with two claws, a strongly curved, toothless anterior one and a similar but much smaller posterior claw. Dorsal setae as follows: Submedian I very large, without barb, obliquely striated, extending for almost one-half its length beyond base of submedian II; submedian II similar to submedian I, but slightly smaller; submedians III–VI subequal, similar to submedian II, except smaller, each may bear a lateral barb; lateral I similar to submedian I, but slightly smaller; lateral II like submedian II; lateral III similar to lateral II, but may bear barb; lateral IV and V absent. Outer pair of posterior marginal setae flagelliform, longer than body; inner pair of posterior marginal setae situated about their length from anal slit.

Length of female, 0.42 mm.; width, 0.25 mm.

Male.—Unknown.

Type host.—Free-tailed bat, *Tadarida cynocephala.*

Type locality.—Leon County, Florida.

Type slide.—U. S. National Museum No. 1282.

Remarks.—Described from three females taken from type host at type locality, April 27, 1934, by E. V. Komarek (Bishopp No. 22331). This species differs somewhat from the other American members of its genus in having each tarsus of the last three pairs of legs provided with two unequal claws and in being without the flattened, spine-bearing thumb (fused segments IV and V) on segment III of the modified first leg.

Radfordia affinis (Poppe).

Myobia affinis Poppe, Zool. Anz., Bd. XIX, s. 337, figs. 7, 8, 9, 1896.
Myobia affinis Vitzthum, Die Tierwelt Mitteleuropas, Bd. III, Lief. VII, s. 56, 1929.
Myobia affinis Radford, North Western Nat., p. 248, figs. 1, 2, 3, 1935.

Female.—Unknown to the writer. According to the original description and figure of the female by Poppe, submedian I is provided with a barb and extends beyong the base of submedian II; lateral I is very stout, longitudinally striated, and with a barb; lateral IV is absent.

Length of female, 0.34 mm.; width, 0.19 mm. (according to Poppe).

Male.—Segment I of first leg about twice as broad as long, without tubercles; segment II about as long as broad, without tubercles; segment III bearing the very strongly curved clasping tubercle and flattened, striated thumb, w ich apparently is without spine. Claws of tarsus II strongly curved, toothless, subequal; tarsi III and IV each provided with a single, very strongly curved, sharp, toothless claw. Dorsal setae as follows: Submedian I small, toothless, reaching scarcely one-half the distance to base of submedian II; submedian II equal to submedian I, situated between genital opening and lateral II; submedian III–V absent, but represented by medians I–III, which are small, simple, subequal, and situated posterior to base of penis; lateral I long, slender, with barb, and extending beyond base of lateral II; lateral II and III subequal to lateral I. Genital opening situated slightly behind level of attachment of second legs. Penis slender, almost straight, sharp-pointed, one-third as long as body.

Length of male, 0.24 mm.; width, 0.14 mm.

Type host.—House mouse, *Mus musculus*.
Type locality.—Europe.
Type.—Location?
Remarks.—Described from a single male found in company with specimens of *Myobia musculi* Schrank on the common house mouse, *Mus musculus*, taken at Takoma Park, Maryland, November 30, 1933, by the writer. It may prove to be a rather rare species in America, for in eight lots of *M. musculi* taken at six different localities (in Delaware, Maryland, District of Columbia, Virginia, and Peru) only a single specimen of *affinis* was found.

Radfordia ewingi (Fox).

Myobia ewingi Fox, Proc. Ent. Soc. Wash., Vol. XXXIX, p. 227, figs. 1–4, 1937.

Female.—First segment of leg I broader than long, without tubercles; segment II as broad as long, strongly concave on side next to capitulum, and bearing a ventral, spinelike tubercle: segment III bearing the strongly curved, somewhat twisted, clasping tubercle and the spine-bearing, flattened, striated thumb. Claws of tarsus II slender, strongly curved, toothless, posterior claw more slender than anterior; tarsi III and IV each provided with a single, slender,

strongly curved, toothless claw. Dorsal setae as follows: Submedian I rather small, longitudinally striated, without barb, reaching to base of submedian II; submedian II very long and slender, longitudinally striated, without barb, extending by about one-half its length beyond base of submedian III; submedians III–V subequal, all similar to submedian II but shorter; lateral I much enlarged near base, longitudinally striated, with vestigial barb; lateral II exceedingly long and slender, reaching to tip of lateral III; lateral III similar to submedian III but smaller; laterals IV and V absent. Outer pair of posterior marginal setae about equal to body in length; inner pair of posterior marginal setae straight, situated about their length from anal slit. Vulva flanked by a pair of backwardly directed, converging tubercles, each bearing at its apex a strongly incurved, simple seta.

Length of female, 0.40 mm.; width, 0.24 mm.

Male.—Leg I as in female. Tarsal claws as in female, except first claw of tarsus II is somewhat shorter and stouter. Dorsal setae as follows: Submedian I small, simple; submedian II small, simple, situated very near and immediately in front of lateral II; submedians III–V absent. Genital opening situated far forward, on capitulum! Penis exceedingly slender, flagelliform for most of its length, about three-fifths as long as body.

Length of male, 0.34 mm.; width, 0.13 mm.

Type host.—Carolina jumping mouse, *Zapus hudsonius americanus*.

Type locality.—Suitland, Maryland.

Type slides.—U. S. National Museum No. 1279.

Remarks.—Described from female holotype, female paratype, and male allotype. This species is unusual in that the genital opening of the male is situated on the capitulum. This is farther forward than in any other mite species known to the writer.

Genus **AMORPHACARUS**, new genus.

Legs of first pair unequal, one being dwarfed; segment I longer than broad, inner margin concave; segment II much broader than long, with dorsal tubercle; segment III distinct from IV, bearing large clasping tubercle; segment IV broader than long, rounded distally. Capitulum asymmetrical. Tarsus II with two claws; tarsi III and IV each with one claw. Some of dorsal setae inflated or foliaceous.

Type species.—*Myobia elongata* Poppe.

Only the type species is included in this new genus. This species is remarkable in the asymmetry of the anterior part of the body. One of the legs of the first pair is about twice as large as the other, which is dwarfed. The dwarfing of the smaller leg is accompanied by a reduction in size of that half of the capitulum on its side and also a reduction in the development of that part of the cephalothorax on its side and in front of the second leg.

Amorphacarus elongatus (Poppe).

Myobia elongata Poppe, Zool. Anz., Bd. XIX, s. 344, figs. 18, 19, 20, 1896.
Myobia elongata Vitzthum, Die Tierwelt Mitteleuropas, Bd. III, Lief. VII, s. 56, 1929.
Myobia elongata Radford, North Western Nat., p. 252, figs. 12–14, 1935.

Female.—Segments of right front leg as follows: Segment I largest, longer than broad, with inner anterior angle produced; segment II about twice as broad as long, with conspicuous, flattened, dorsolateral process; segment III twice as broad as long, with short, curved, clawlike, clasping tubercle; segment IV distinct from III but completely fused with V so as to form broadly rounded, striated, terminal element of leg. One front leg, usually the left, about half as large as other but otherwise similar. Claws of tarsus II unequal, the posterior being only about one-half as long as anterior, both strongly curved, toothless. Tarsi III and IV each with a single, long, slender, curved, toothless claw. Dorsal setae as follows: Submedian I considerably smaller than lateral I, flattened towards its base and situated much more anteriorly than lateral I; submedian II smaller than submedian I, situated near lateral II but more posteriorly; submedians III–V subequal, each flattened and somewhat foliaceous and with imperfect lateral barb; lateral I flattened, extending by one-third its length beyond lateral II; lateral II exceedingly long and slender, extending by more than one-half its length beyond base of lateral III; lateral III likewise very long, reaching almost to tip of abdomen; lateral IV absent. Outer pair of posterior marginal setae almost straight, longer than body; inner pair of posterior marginal setae straight, situated less than their length from anal slit.

Length of female, 0.44 mm.; width, 0.22 mm.

Male.—Unknown to the writer. The male of this species is peculiar, according to both Poppe and Radford, in that the penis is twice looped near its middle.

Length of male, 0.35 mm.; width, 0.15 mm. (according to Poppe).

Type host.—*Sorex vulgaris*, now *S. araneus*.
Type locality.—Europe.
Types.—Located?
Remarks.—Radford, in his description of *elongata*, states that it is the left front leg which is the larger of the first pair. In the case of two of the three females before the writer the right leg of the first pair is the larger. This is also true in both of the nymphs. Only in the case of one individual (a female) out of these five American specimens is it the left leg which is the larger.

Description based on three females, two taken from *Sorex cinereus cinereus* collected at Chimney Pond, Mt. Katahdin, Maine, August 27, 1927, by Francis Harper and one taken along with two nymphs from the same host at Lakes of the Clouds, Mt. Washington, New Hampshire, June 28, 1927, by Francis Harper (No. 566).

Genus **MYOBIA** Heyden, 1826.

Myobia Heyden, Isis, Bd. XIX, Heft 6, s. 613, 1826.
Dermaleichus, C. L. Koch, Ubers. Arachnid., Heft 3, s. 122, 1842 (in part).
Myobia Gervais, In Walckenaer's Hist. Nat. Insects, T. III, Aptères, p. 265, 1844.
Myobia Mégnin, Jour. Anat. et Phys., T. XIV, p. 430, 1878.
Myobia Michael, Jour. Quekett Micr. Club, Vol. II, Ser. II, p. 1, 1884 (in part).
Myobia Canestrini, Prosp. Acarof. Italiana, Pt. II, p. 170, 1886 (in part).
Myobia Berlese, Acari Myriopoda et Scorpiones Ital. Rep., Fasc. LVI, n. 1, 1889 (in part).
Myobia Trouessart, Bul. Soc. Ent. France, No. 8, p. ccxiii, 1895 (in part).
Myobia Poppe, Zool. Anz., Bd. XIX, s. 327, 1896 (in part).
Myobia Banks, Proc. U. S. Nat. Mus., Vol. XXVIII, p. 19, 1905 (in part).
Myobia Banks, Proc. U. S. Nat. Mus., Vol. XXXII, p. 597, 1907 (in part).
Myobia Fahrenholz, Abh. Nat. Ver. Bremen, Bd. XIX, Heft 3, s. 359, 1909 in part).
Myobia Banks, U. S. Dept. Agr., Of. Sec., Rept. 108, p. 27, 1915 (in part).
Myobia Vitzthum, Die Tierwelt Mitteleuropas, Bd. III, Lief. VII, s. 56, 1929 (in part).
Myobia Ewing, Manual of External Parasites, p. 30, 1929 (in part).
Myobia Radford, North Western Nat., p. 356, 1934 (in part).

Legs of first pair equal, each composed of three or four segments; when four segments are present, segment III partly anchylosed with IV. Segment III provided with a large, lateral, hooklike, clasping tubercle and a terminal, flattened, spine-bearing thumb. Tarsus II with a single claw; tarsus III usually with a single claw; tarsus IV with a single claw. Dorsal setae variously modified.

Type species.—*Pediculus musculi* Schrank.

Besides the type species this genus includes at least three other described species, *Myobia brevihamata* Haller, *M. poppei* Trouessart, and *M. caudata* Banks, as well as two species described in this paper as new.

KEY TO THE NORTH AMERICAN SPECIES OF THE GENUS MYOBIA HEYDEN.

A. Large, clawlike, clasping tubercle of leg I moves horizontally or almost so; some of dorsal setae inflated and striated.....
M. musculi (Schrank).

AA. Large, clawlike, clasping tubercle of leg I moves almost vertically.

B. Most of dorsal setae inflated and striated; body very slender. On a bat.....*M. longa*, new species.

BB. None of dorsal setae inflated or striated; body of usual proportions.

C. Segment II of leg I with a prominent lateral, downwardly-hooked striated process. On shrews.....
M. simplex, new species.

CC. Segment II of leg I without any such hook. On a bat....
M. caudata Banks.

Myobia musculi (Schrank).

Pediculus muris musculi Schrank, Enum. Insect. Aust. Indig., p. 501, 1781.
Myobia coarctata Heyden, Isis, Bd. XIX, Heft 6, s. 613, 1826.
Myobia musculina Gervais, In Walckenaer's Hist. Nat. Insectes, T. III, Aptères, p. 265, 1844.
Myobia musculi Claparède, Zeitsch. f. Wissensch. Zool., Bd. XVIII, s. 519, 1869.
Myobia musculi Mégnin, Jour. Anat. Phys., T. XIV, p. 432, Pl. XXXI, 1878.
Myobia musculi Canestrini, Prosp. Acarof. Ital., Pt. II, p. 176, Pl. XI, fig. 1, 1886.
Myobia musculi Poppe, Zool. Anz., Bd. XIX, s. 330, figs. 1, 2, 3, 1896.
Myobia musculi Banks, Proc. U. S. Nat. Mus., Vol. XXXII, p. 597, 1907.
Myobia musculi Vitzthum, Die Tierwelt Mitteleuropas, Bd. III, Lief. VII, s. 56, 1929.
Myobia musculi Radford, North Western Nat., p. 357, figs. 1–6, 1934.

Female.—First segment of leg I broader than long; segment II as long as broad, with low ventral tubercle; segment III with curved, somewhat twisted, sharp-pointed, clasping tubercle and flattened, striated, well sclerotized thumb. Tarsi II, III, and IV each armed with a slender, curved, toothless claw, the one on tarsus II the shortest. Dorsal setae as follows: Submedian I broad, longitudinally striated, with barb, extending almost to base of submedian II; submedian II with or without barb, extending beyond base of submedian III; submedians III–V each without barb, IV longer than III, V longer than IV; lateral I much stouter than other dorsal setae, longitudinally striated, with conspicuous barb, and extending slightly beyond base of lateral II; lateral II slender, with barb; lateral III similar to lateral II but stouter; lateral IV considerably shorter than lateral III, with barb. Outer pair of posterior marginal setae slightly longer than body; inner pair of posterior marginal setae situated less than their length from anal slit.

Length of female, 0.36 mm.; width, 0.19 mm.

Male.—Leg I as in female. Tarsal claws as in female. Dorsal setae as follows: Submedian I very small, with barb, extending about half way to base of submedian II; submedian II with barb, about one-half as long as lateral II and situated between the latter and median line; submedians III and IV much reduced, each with barb and situated near each other at lateral border of genital area; submedians V and VI absent but in their stead two medians situated much behind genital opening; lateral I not enlarged, with barb, extending slightly beyond base of lateral II; laterals II and III very long, subequal, each with barb; lateral IV absent. Genital opening situated at level of second pair of legs; penis very long and slender, basal half somewhat bent and rodlike, distal half flagelliform, becoming threadlike towards its tip. (In one male specimen this threadlike tip of penis is protruded through the genital opening, forward to the base of the capitulum.)

Length of male, 0.27 mm.; width, 0.16 mm.

Type host.—House mouse, *Mus musculus*.
Type locality.—Austria.
Types.—Location unknown.

Remarks.—Although only the adult male and female are here described, all stages are represented in the material at hand. This species has been taken only from *Mus musculus* in North America. From this host we have records as follows: Ft. Dupont, Delaware, April 13, 1933, by H. S. Peters; Silver Spring, Maryland, July 17, 1930, by H. E. Ewing; Takoma Park, Maryland, August 11, October 20, November 30, all in 1933, by H. E. Ewing; District of Columbia, November, 1891; Virginia Beach, Virginia, July 16, 1928, by C. East and H. E. Ewing.

Myobia longa, new species.

Female.—Capitulum very short, much broader than long; palpi reduced, each composed of two partly anchylosed segments and a terminal recurved claw. Leg I four-segmented; segment I much enlarged, being the largest and broadest segment, with a vertical spine on anterodorsal margin; segment II about twice as broad as long, with conspicuous, obliquely striated, upturned, lateral process; segment III small, not as large as the swollen, upwardly-curved, transversely-striated, clasping tubercle it bears; segment IV much broader than long, distinctly separated from III and bearing a conspicuous, stout, procurved, ventral, spinelike process. Tarsi II, III and IV each bearing a single, slender, strongly-curved, toothless claw, the one on tarsus II being the shortest and the one on tarsus IV the longest. Dorsal setae all semifoliaceous, longitudinally striated and without barb; submedian I more spinelike than any of the others; reaching to base of submedian II; submedian II with sides subparallel for most of its length, but ending in a flagelliform tip; submedian III similar to submedian II, but shorter; submedians IV and V subequal, the shortest of the dorsal setae; submedian VI similar to V but slightly larger; lateral I similar to submedian I except that it is flagelliform toward its tip; laterals II and III subequal and very similar to submedian II; laterals IV and V absent. Outer pair of posterior marginal setae longer than body and situated near median line.

Length of female, 0.63 mm.; width, 0.21 mm.

Male.—Capitulum, leg I, and tarsal claws as in female. Dorsal setae all longitudinally striated and without barbs; submedian I much smaller than lateral I and situated more posteriorly; submedian II on right side large, reaching to submedian III, and situated adjacent to genital opening; submedian II on left side very minute, almost invisible; submedian III short, foliaceous; submedian IV longer than submedian III, but not so broad; submedians V and VI absent; lateral I large, straight, extending to base of lateral II; lateral II subequal to lateral I; lateral III largest of all dorsal setae, curved strongly toward median plane. Large posterior marginal setae longer than body and situated on a single, cylindrical, median tubercle. Genital opening situated behind level of second pair of legs and accompanied by strongly sclerotized, asymmetrical, internal armature: penis very slender, flagelliform for most of its length, about one-half as long as body.

Length of male, 0.51 mm.; width, 0.21 mm.

Type host.—A bat, *Tadarida mexicana.*

Type locality.—Berkeley, California.

Type slide.—U. S. National Museum No. 1283.

Remarks.—Described from one female and one male taken from type host at type locality October 12, 1934. This species is unusual in certain respects, particularly in the great reduction of the capitulum and its palpi, also in the great enlargement of segment I of leg I. The asymmetrical nature of the internal genital armature adjacent to the genital opening is also unusual.

Myobia simplex, new species.

Female.—Leg I four-segmented; segment I as broad as long, without tubercle; segment II about twice as broad as long, with large, curved, striated, hooklike, lateral tubercle; segment III with clasping tubercle short, down-curved, truncate, and transversely striated; segment IV three to four times as broad as long, terminal, striated, with convex anterior surface. Tarsi II, III, and IV each armed with a single, slender, strongly-curved, toothless claw, the one on tarsus IV slightly the largest. Dorsal setae not striated; submedian I small, without barb, reaching less than half distance to base of submedian II; submedian II similar to submedian I but smaller, situated very near to lateral II, but more posteriorly; submedians III–V small, simple, V longer than other two; lateral I long, slender, without barb; extending backward beyond bases of lateral II by almost one-half its length; lateral II longest of dorsal setae, reaching to tip of submedian V; lateral III long, slender, extending to tip of abdomen; laterals IV and V absent. Outer pair of posterior marginal setae about as long as body.

Length of female, 0.54 mm.; width, 0.29 mm.

Male.—Unknown.

Type host.—Short-tailed shrew, *Blarina brevicauda talpoides.*

Type locality.—Smoky Mountains, Tennessee.

Type slide.—U. S. National Museum No. 1284.

Remarks.—Described from three females taken from type host at type locality in 1931 by R. L. Boke (B8) and three females collected from *Blarina brevicauda* taken at Terra Cotta, District of Columbia, November 24, 1924, by Paul Bartsch. The last-named females were accompanied by females and a male of *Protomyobia claparèdei* (Poppe). *M. simplex* has the front legs four-segmented and of a type similar to the front legs of the bat-infesting *Myobia longa*, new species, but otherwise the two species are very different.

Myobia caudata Banks.

Myobia caudata Banks, Proc. Ent. Soc. Wash., Vol. XI, p. 134, 1909.
Myobia canadensis Banks, Ibid., p. 143, 1909.
Myobia canadensis Banks, U. S. Dept. Agr., Of. Sec., Rept. 108, p. 29, 1915.
Myobia caudata Radford, North Western Nat., p. 150, 1936.

The writer has never seen a specimen of this species, hence the original description given by Banks is here quoted:

"Body about twice as long as broad, broadest behind coxae IV, plainly constricted behind coxa I and behind coxa II, abdomen behind hind legs broadly

rounded. Dorsum with a submedian row of long, slender bristles, at tip of abdomen a pair of very long bristles arising from small tubercles, in fact longer than the entire body. Legs short and stout, tapering to the tip, each with various short hairs and a few larger bristles, usually near the tip; first pair modified as usual, the claw at tip is rather more curved than in *M. musculi;* claws at tips of other tarsi are rather shorter and more curved than in *M. musculi.*

"Length, 0.2 mm.

"Guelph, Ontario, Canada, on little brown bat.

"Differs from *M. musculi* in more elongate form, slender dorsal bristles, longer bristles near tips of legs, shorter claws, etc."

Remarks.—In this original description there is no indication of the sex. Under the name of *Myobia canadensis*, Banks (1915), published a figure of this species. Unfortunately this figure is of the ventral aspect, thus revealing none of the characters indicating the sex. Because females are much more abundant than males there is a strong presumption that the description applies to the first mentioned sex. The shape of the body and also that of the first pair of legs as revealed by Banks's figure are typical for a bat-infesting species.

A NEW GENUS AND SPECIES OF ANOPLURA FROM THE PECCARY.

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During the winter of 1932 a month-old peccary (javelina) was captured about midway between Juno, Tex., and the Pecos River, in one of the few remaining areas where this animal still roams wild. An examination of this individual revealed that it was heavily infested with a sucking louse. The lice were abundant on the sides and back, while the forequarters and shoulders were even more heavily infested. Attached to the bristles down very close to the skin were many eggs, a very small percentage of which were unhatched.

This louse represents a new genus and species and is the first anopluran to be recorded from the peccary.

PECAROECUS, new genus.

Head long and slender; fore head somewhat narrower than hind head; temporal region necklike; antenna five-segmented, segment I much broader than the others, segment V reduced but distinctly separated from IV. Eyes distinct, each with a well-developed cornea and ocular seta. Thorax only slightly reduced, longer than broad as viewed from below; thoracic spiracles dorsal; notum obliterated. Legs large, somewhat semicircular; leg I with femur swollen and an

enormous tibial thumb; legs II and III subequal, each with a large tarsus and a very large, toothed, tarsal claw. Abdomen long, rather slender, lobed laterally; laterotergal plates small, oval, well sclerotized; a single transverse row of dorsal setae to a segment; spiracles on segments III to VIII. Last abdominal segment in female strongly bilobed. Genital armature of male with clasperlike parameres; penis absent; pseudopenis V-shaped.

Type species.—Pecaroecus javalii, new species.

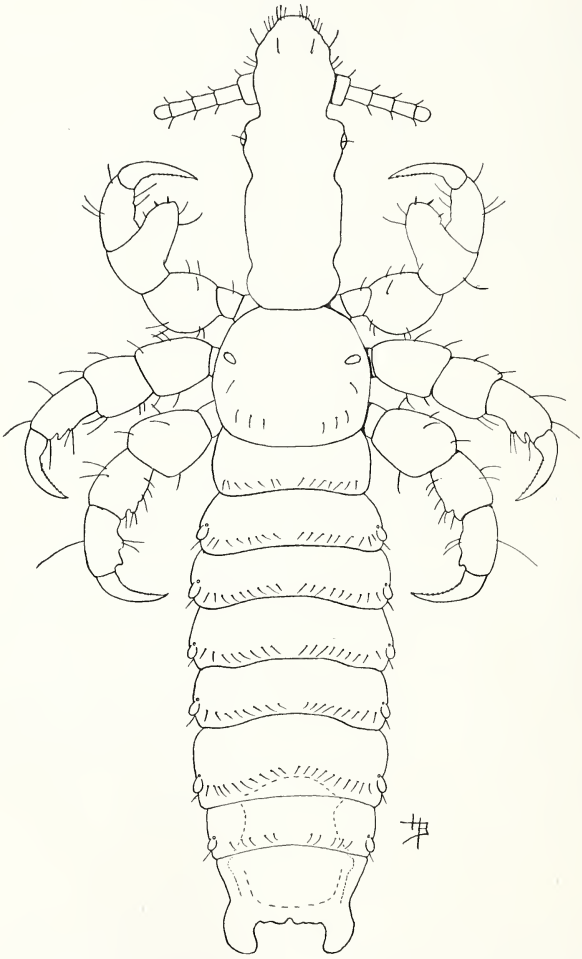


Figure 1.—*Pecaroecus javalii*, new genus and species. Dorsal view of female, × 18.

This genus is most nearly related to *Microthoracius* Fahrenholz, from which it differs in having the last segment of the antenna

always distinct, the thorax only slightly reduced, the first pair of legs modified, the abdomen lobed laterally and provided with distinct laterotergal plates. The dorsal setae in *Pecaroecus* are arranged, for the most part, in a single transverse row per segment, while in *Microthoracius* they are not arranged in rows. Finally, in this new genus the last segment of the abdomen is strongly bilobed in the female, while in *Microthoracius* it is practically unlobed. Also, there are differences between the two genera in the plan of the male genital armature. *Pecaroecus* shares with *Haematopinus* Leach the lateral lobing of the abdomen, the presence of small, oval, laterotergal plates, and a similar arrangement of the abdominal setae, but otherwise these two genera are very different. *Pecaroecus* stands as the most generalized anopluran genus yet reported from ungulates.

Pecaroecus javalii, new species.

Male.—Conical forehead slightly broader than long. Antennae much shorter than head, each situated in a broad, lateral, cephalic emargination; segment I much broader than long, II longer than I but only about one-half as broad, III slightly longer than II and of about the same width, IV slightly shorter and slightly broader than II, V about one-half as long as IV, with a single sensory pit situated posteroventrally at base. Hind head constricted behind the large, broad, ocular tubercles and again near its base, which overlaps the thorax dorsally to some extent. Thorax as broad as first two (fused) abdominal segments, broadest near middle; thoracic spiracles pear-shaped in outline, situated dorsal to mid-coxae. Femur I slightly longer than broad, very strongly swollen posteriorly; tibia I with enormous thumb which is as long as the segment itself and bears subapically two stout spines; tarsus I as long as tibia I and bearing distally a tarsal claw. Tarsal claw of each leg with a row of transverse ridges and many teeth on its inner surface. Abdomen long, not swollen toward middle; each spiracle of the six pairs present, situated at the base, and on anterior side of its corresponding laterotergal plate. Oval laterotergal plates situated laterally on segments III to VIII. Basal plate of genital armature from three to four times as long as broad, much thickened toward lateral margins, which are incurved; parameres about three-fifths as long as basal plate, flattened, each ending in a stout, heavily pigmented, outcurved hook; dorsal endomere forming V-shaped pseudopenis; ventral endomere complicated, extending forward much beyond bases of parameres as a broad, bilobed process and backward to tip of pseudopenis as a platelike process.

Length of male 6.30 mm., width, 1.40.

Female.—Similar to male except for size and structure of terminal segments of abdomen. Last segment of abdomen ending in a pair of large dorsolateral lobes, each of which has an outwardly curved lateral margin and an almost straight inner margin. Gonopophyses large, flat, subtriangular, arising from posterior margin of abdominal segment VIII, each with a brush of straight setae near outer border. Genital plate large, pigmented; lateral margins rounded; posterior margin straight.

Length of female 6.90 mm., width 1.45 mm.



Figure 2.—*Pecaroecus javalii*, new genus and species. Dorsal view of first instar, greatly enlarged. (Photo by Babcock.)

First nymph.—In addition to its smaller size, it differs from the adult as follows: Body much smaller in proportion to legs; head broader in proportion to length; laterotergal plates undeveloped; body as a whole less sclerotized and pigmented.

Length of first nymph 2.30 mm., width, 0.65 mm.

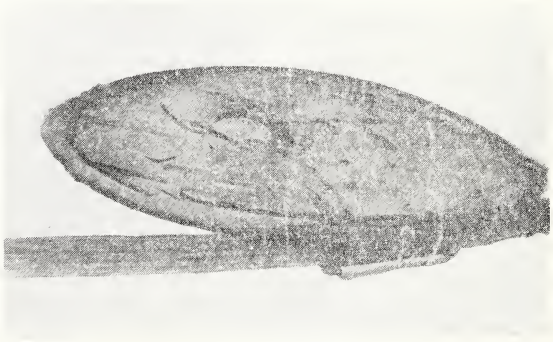


Figure 3.—*Pecaroecus javalii*, new genus and species. Egg attached to hair of peccary, greatly enlarged. (Photo by Babcock.)

Egg.—Large, elongate elliptical, whitish in color; attachment sheath of cement cup without pedicel, in length equal to about one-third length of egg; operculum much less in diameter than egg; nodular area more than one-half the diameter of operculum and composed of many small cellulae.

Length of egg 2.54 mm., width, about one-third of length.

Type host.—*Pecari angulatus*, collared peccary.
Type locality.—Western Texas.
Type slides.—U. S. National Museum No. 52758.

Different instars described from many specimens taken from type host between Juno, Tex., and Pecos River, January 29, 1932, by O. G. Babcock.

This unusually large and rather peculiar louse deserves, and undoubtedly will receive, additional study, which should throw further light on the phylogeny of ungulates and their sucking lice.

Inside many of the attached eggshells of this new louse were found mites of a species of Sarcoptidae. Why the mites enter these shells is not known. However, one of us (Babcock) suggests a possible explanation. It is believed that the mites enter the eggshells to get protection during a quiescent stage. Such protection would be needed, since peccary bristles are very coarse and very scattering, giving little protection to a scab mite that does not actually burrow into the skin. It should be added that no mites were found on the skin itself.

THREE NEW REARED SPECIES OF APANTELES FROM CALIFORNIA (HYMENOPTERA : BRACONIDAE).

By C. F. W. Muesebeck,
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The following descriptions are presented at this time in order to provide the senders of the specimens with names for the species involved.

Apanteles insignis, new species.

In my key to the Nearctic species of this genus[1] the present form will run to couplet 73 and is most similar to *neomexicanus* Mues. It may be immediately distinguished from that species, however, by its much broader and shorter second tergite, smoother propodeum, broad metatarsus, and straight ovipositor.

Female.—Length about 3 mm. Face smooth and shiny; malar space a little shorter than clypeus; temple narrow but not strongly receding; antenna slightly shorter than body, the four preapical segments at least as broad as long.

Mesoscutum minutely and shallowly punctate, strongly shiny, the punctures gradually fainter caudad; disk of scutellum longer than broad, smooth and shiny; propodeum smooth and shiny, with a strip along each lateral margin, and a broad median area, finely rugulose; mesopleurum mostly polished, with only indistinct punctures anteriorly; metapleurum mostly smooth, rugulose apically;

[1] Proc. U. S. National Museum 58 : 483–576, 1920.

posterior coxa polished outwardly, an elongate punctate area on upper edge at base; inner calcarium of hind tibia conspicuously longer than outer but not extending quite to middle of metatarsus; metatarsus unusually stout; stigma short and broad, definitely shorter than metacarpus; first abscissa of radius perpendicular to anterior margin of stigma and not, or barely, longer than intercubitus; a short but conspicuous stub outwardly at junction of radius and intercubitus.

Abdomen fully as long as thorax; sclerotized plate of first tergite narrowing very gradually caudad but still twice as broad at apex as greatest length of second tergite, very finely rugulose; plate of second tergite more than three times as broad as long, smooth and shiny on more than the middle third, finely rugulose and dull laterally; hypopygium large, its apex attaining apex of last tergite; ovipositor sheath as long as posterior tarsus, very slender at base, but broadening conspicuously toward apex.

Black; antennae entirely black; tegulae bright yellow; legs yellowish brown, including anterior and middle coxae; posterior coxa black, extreme apex of hind femur above, apical third of hind tibia, and most of hind tarsus infuscated; wings hyaline, stigma black, veins brown; membranous margins of first and second tergites brownish yellow.

Male.—Like the female in all essential characters.

Type.—U. S. National Museum No. 52888.
Type locality.—Half Moon Bay, Calif.
Host.—*Platyptilia acanthodactyla* (Huebner).

Described from four specimens reared by W. H. Lange. The type female was reared December 13, 1937, the allotype December 5, and the two female paratypes December 18, 1937, and January 31, 1938, respectively.

Apanteles langei, new species.

This runs to couplet 130 in the key[1] mentioned under the preceding species, but it is altogether unlike either of the two species included there. It much more closely resembles *pyraustae* Viereck, but differs in having black legs, even shorter antennae in the female, and distinct longitudinal sculpture across the base of the third tergite.

Female.—Length about 2 mm. Face minutely punctate, shiny; malar space a little longer than clypeus; antenna very short, not longer than head and thorax combined; most of the flagellar segments as broad as, or broader than, long.

Thorax a little depressed, being slightly broader than high; mesoscutum with separate punctures, the punctures confluent in a short oblique area on each side of the middle toward apex; scutellum polished; propodeum completely, strongly rugose and dull; mesopleurum distinctly punctate anteriorly, otherwise polished; posterior coxa mostly smooth, with a flattened elliptical area at base above weakly punctate; inner calcarium of posterior tibia definitely more than half as long as metatarsus; stigma shorter than metacarpus; radius directed outward, strongly angled with the intercubitus and only slightly longer than the latter.

Abdomen not longer than thorax; plate of first tergite large, broadening behind, entirely rugulose and dull; second tergite much shorter than third, its sclerotized plate entirely, finely rugulose; third tergite very finely, longitudinally aciculate at base, otherwise polished like the following tergites.

Black; antennae entirely black; wings hyaline, stigma and veins brown; legs black, with apices of fore femora, fore and middle tibiae entirely, and posterior tibiae, except toward apices, reddish brown.

Male.—Like female except for elongate antennae, which are at least as long as the body.

Type.—U. S. National Museum No. 52889.
Type locality.—Half Moon Bay, Calif.
Host.—*Pyrausta subsequalis* Guenée.
Described from six females and one male reared September 22, 1936, by W. H. Lange.

Apanteles dignus, new species.

Runs to couplet 65 in my key[1] and is most similar to *sesiae* Vier., from which it is distinguished especially by the much smoother mesoscutum and first and second tergites, the strongly oblique lateral grooves of second tergite, and the yellow posterior coxae and shorter ovipositor sheath of the female.

Female.—Length about 2.2 mm. Head thin anteroposteriorly, temple narrow and receding; face faintly punctate and shiny; malar space about as long as clypeus; antenna at least as long as body, all flagellar segments elongate.

Thorax slightly broader than high; mesoscutum very minutely punctate, shiny; disc of scutellum smooth and shiny; propodeum smooth and shiny, with a prominent and complete median longitudinal carina; mesopleurum and metapleurum entirely smooth and polished; inner calcarium of posterior tibia distinctly longer than the outer but barely half as long as metatarsus; stigma a little shorter than metacarpus; first abscissa of radius and the intercubitus subequal.

Abdomen as long as thorax; sclerotized plate of first tergite narrowing gradually from base to apex, with a median longitudinal impressed line on basal two-thirds, smooth except for a little weak sculpture on apical third; plate of second tergite strongly transverse, shorter than that of first tergite is broad at apex, defined at each side by a strongly oblique groove, smooth and shiny; lateral membranous margins of first and second tergites very broad; ovipositor sheath at least as long as posterior femur.

Black; clypeus and mouth area, also scape of antenna, reddish yellow; tegula pale yellow; wings hyaline; stigma and veins transparent yellowish, the former margined with light brown; legs, including all coxae, honey yellow, with only extreme apex of posterior tibia and the posterior tarsus infuscated; sides of abdomen and the broad membranous margins on first and second tergites bright yellow; sclerotized plate of first tergite more or less reddish yellow or brown on basal half, apical half darker; following tergites varying from brown to blackish.

Male.—Like the female except that posterior coxae are black, posterior tibiae more broadly infuscated apically, and abdomen darker, the first tergite being entirely blackish.

Type.—U. S. National Museum No. 52890.
Type locality.—Santa Ana, Calif.
Host.—*Gnorimoschema lycopersicella* (Busck).

Described from five females and four males. The type, allotype, and four paratypes reared by J. C. Elmore and A. F. Howland at the type locality, the type and three paratypes on June 27, 1936, and the allotype and one paratype on October 28, 1936. One of the remaining paratypes is from Vista, Calif., reared November 25, 1936; one from Long Beach, Calif., reared November 22, 1937, and one from Irving, Calif., reared December 6, 1937. In addition to the type series I have before me three females and two males, unquestionably of the same species, reared from *Gnorimoschema gudmannella* (Wlsm.) at St. Croix, Virgin Island, in March, 1922.

ANCYLODERES, A NEW GENUS OF SCOLYTIDAE.

By M. W. Blackman,
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

In a revisional paper published in 1931[1] the writer removed the form originally described as *Cryphalus pilosus* Lec. from the genus *Pseudopityophthorus*, where it had been placed by Swaine (1918),[2] but did not assign it to another genus. This rather unsatisfactory action was taken because, while an earlier examination had indicated that *pilosus* did not belong to any of the genera to which it had been assigned, a reexamination of the type was desirable before definitely disposing of the species. This reexamination shows that Leconte's species represents an undescribed genus, a description of which, accompanied by a redescription of a cotype and a description of a closely allied species, is presented here.

The species in question was described by Leconte (1868)[3] in the genus *Cryphalus* Er. In his key to the species on page 154 Leconte refers to it as *pilosus* and it is so named in the list of species on page 178. However, in looking up these references,

[1] A Revisional study of the genus *Pseudopityophthorus* Sw. in North America, M. W. Blackman, Jour. Wash. Acad. Sci. XXI : 223–236, 1931.

[2] Canadian Bark Beetles, J. M. Swaine, Canada Dept. Agr. Ent. Branch Bull. 14, pt. 2 : 1–142, 1918.

[3] Appendix to Zimmermann's Synopsis of Scolytidae, J. L. Leconte, Trans. Amer. Ent. Soc. II : 150–178, 1868.

one by species number and the other by page number the writer finds the name heading the description to be *C. pilosulus*. The first name used in the key by which the species in question is distinguished from all the others discussed is *pilosus*, and in the writer's opinion this name should stand in spite of the fact that Leconte in a later paper (1876)[4] refers it to the genus *Pityophthorus* under the name of *pilosulus*.

ANCYLODERES, new genus.

Generic characters.—Body form slender, cylindrical; front of the head plano-convex, finely, convergently aciculate; antennal club nearly 1.5 times as long as the five-jointed funicle, broad oval, first segment nearly as wide as others, with three sutures, the first two chitinized; pronotum with dorsal outline evenly convex, the summit not elevated, anterior margin extended and with broad low serrations, anterior area with broad, very low asperities, rather closely and deeply punctured behind; elytral punctures fine, confused. Allied to *Gnathotrichus* Eichh. but differing in pronotal, antennal, and other characters.

Type species.—*Cryphalus pilosus* Leconte.

Ancyloderes pilosus (Leconte).

Cryphalus pilosus Leconte, Amer. Ent. Soc. Trans. 2 : 154, 178, 1868.
Cryphalus pilosulus Leconte, Amer. Ent. Soc. Trans. 2 : 166, 1868.
Pityophthorus pilosulus (Leconte), Amer. Phil. Soc. Proc. 15 : 350, 351, 1876; Swaine, N. Y. State Mus. Bull. 134 : 136, 1909.
Pseudopityophthorus pilosulus (Leconte), Swaine, Canada Dept. Agr. Ent. Branch Bull. 14, pt. 2 : 94, 1918.

Redescription of Cotype.—Light reddish brown; 2.11 mm. long, 3.08 times as long as wide.

Front of the head not visible in the type, but in the cotype and in specimens in author's collection, finely convergently aciculate with a few fine punctures interspersed. *Antenna* slightly lighter in color, the club 1.48 times as long as funicle, 1.3 times as long as wide, broad oval, segments 2 and 3 subequal in width and segment 1 but slightly narrower, the first two segments comprising more than half the length of club, the first two sutures chitinized, weakly arcuate. *Eye* short oval, the inner line moderately emarginate.

Pronotum 1.25 times as long as wide, the sides subparallel (feebly arcuate) on the posterior half, then evenly narrowed, and broadly rounded in front; the margin slightly extended over the head and armed with about ten very low, broad serrations; the anterior two-fifths ornamented with very fine low asperities, becoming finer posteriorly and passing over into punctures at the summit; summit not elevated above the even contour of pronotum; posterior area finely, evenly, deeply, moderately closely punctured, the median line impunctate, not elevated, the basal marginal line very feeble and incomplete.

[4] The Rhynchophora of America North of Mexico, J. L. Leconte and G. H. Horn, Amer. Phil. Soc. Proc. 15 : 445 pp., 1876.

Elytra equal in width to pronotum, 1.83 times as long as wide; the sides nearly straight, subparallel, moderately rounded behind; surface moderately shining, rugulose, very finely punctured, with no indication of striae on the disc, the punctures bearing fine short hairs. *Declivity* rounded, with the sutural area feebly flattened, with a few extremely fine granules in the third interspace; the hairs considerably longer and more abundant.

The type series consists of two specimens both collected in California. The second specimen agrees with the type in all essentials but is slightly darker in color. Two specimens in the author's collection taken in flight by him at Northfork, Calif., October 4, 1926, also agree in all essentials. No sexual differences were noted in the four specimens. Nothing is known regarding the habits and host.

Ancyloderes saltoni, new species.

Chestnut-brown; 2.4 mm. long, 3.23 times as long as wide.

Front of the head feebly flattened, finely convergently aciculate-punctate, the median line finely carinate. *Eye* short oval, the inner line emarginate. *Antenna* similar to that of *pilosus*, the septi of the first two sutures subtransverse, pigmented.

Pronotum 1.3 times as long as wide, widest near the middle, the sides evenly arcuate, rather broadly rounded in front; the anterior margin extended over the head and armed with about twelve broad low serrations; anterior area with fine, rather broad and low asperities, the summit not elevated, posterior area closely and finely punctured except in the smooth median line; posterior marginal line not complete.

Elytra not wider than pronotum, 1.92 times as wide as long, the sides subparallel, rather narrowly rounded behind, the surface moderately shining, finely rugulose, rather finely, confusedly punctured, with the hairs on the disc fine, shorter, and less abundant than in *pilosus*. *Declivity* arched, rather abrupt; the sutural area feebly subsulcate; the suture not elevated, third interspace distinctly, but not strongly elevated and armed with a sparse row of fine granules; the hairs much longer and more abundant than on the disc, and more abundant than in *pilosus*.

Type Locality.—Flagstaff, Arizona.

Type.—U. S. National Museum No. 52849.

The type bears the data "Flagstaff, Ariz., 8–14–20; R. C. Salton, Collector; Lot No. 1210." It was taken as it, together with specimens of other scolytids, settled upon objects about camp.

We thus have no record of a host plant for either of the species of *Ancyloderes*, but both the single specimen of this species and the two specimens of *pilosus* taken by the writer at Northfork, Calif., were in flight in a forest of yellow pine, *Pinus ponderosa*. It is not believed this tree is the host, however.

MINUTES OF THE 493D REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

The 493d meeting of the Society was held at 8 P. M., Thursday, June 2, 1938, in Room 43 of the National Museum. President Back presided and 47 members and 12 visitors were present. The minutes of the previous meeting were read and approved.

In accordance with the suggestion made by the President at the May meeting, an opportunity was given for discussion of the proposed Memoirs of the Entomological Society of Washington. No discussion occurred, however, and it was voted that the recommendations of the committee, as presented at the May meeting, be adopted.

E. H. Siegler called attention to a picnic being given by the Insecticide Society of Washington. In response to the invitation, it was voted to join with the Insecticide Society at this picnic.

The regular program consisted of a symposium on Insect Control and included the following papers by members of the Bureau of Entomology and Plant Quarantine:

1. Outline of the work of the Division of Control Investigations. L. A. Hawkins.
2. Physiology of insects. J. F. Yeager.
3. Toxicology of insects. E. R. McGovran.
4. Nicotine as an insecticide. H. H. Richardson.

NICOTINE AS AN INSECTICIDE.

(*Abstract.*)

Some insects were very remarkably susceptible to nicotine in the gaseous stage, while others were very resistant. They may be classified roughly in groups in the order of increasing resistance to nicotine as (1) aphids, Hymenopterous parasite, silkworm larvae, whitefly, and codling moth adult; (2) leafhoppers; (3) thrips and 1st-instar southern armyworm; (4) the red spider mite and 2d-instar southern armyworm; (5) housefly, tobacco flea-beetle, American cockroach; (6) 4th-instar southern armyworm; (7) honeybee; (8) 6th-instar southern armyworm. The first three groups with the exception of the thrips on chrysanthemum (*Thrips nigropilosus*) might be termed the nicotine-susceptible groups. The majority of these could be killed by concentrations of nicotine varying from 0.005 to 0.025 mg. nicotine per liter (approximately 1 to 4 parts per million) in a 30-minute fumigation at 25° C. (77° F.). It is against these insects that nicotine probably offers the most promise in practical control. The aphids were found to vary greatly among themselves in susceptibility, some of these needing four times the concentration of nicotine needed to kill others. The aphids may be placed in the following order of increasing resistance: (1) the bean aphid, the strawberry root aphid, green peach aphid on nasturtium; (2) lettuce aphid; (3) chrysanthemum aphid, green peach aphid on climbing dahlia; (4) pea aphid, rose aphid; (5) cabbage aphid; (6) green peach aphid on turnip. The four species of thrips varied widely also. The gladiolus thrips and the onion thrips (*T. tabaci*) on horsebean were about equally susceptible. The sugarbeet thrips (*H. femoralis*) was more resistant, and the thrips (*T. nigropilosus*) on chrysanthemum was most resistant, requiring over three times the nicotine concentrations needed to kill the first two.

The susceptibility of the green peach aphid, *M. persicae*, was found to vary greatly on three different host plants, it being greatest on nasturtium, intermediate on climbing dahlia, and least on turnip. On the other hand, that of the sugarbeet thrips did not appear to vary much whether reared on cucumber, chrysanthemum, or horsebean.

The slopes of the toxicity curves (data plotted with concentration against mortality) for the various insects were by no means parallel so that the 50 per cent or median lethal concentrations could not be used to forecast the practical value of the fumigant; i. e., concentration needed to kill 95–100 per cent of the insects. It would seem advisable to make comparison of the relative practical value of insecticides or relative susceptibility of insects in a higher mortality range even though it is recognized that a greater number of insects must be used in order to obtain the accuracy of the 50 per cent or median lethal concentration.

Studies on the relation of exposure time and concentration on the efficiency of nicotine fumigation were made with 3 different aphids and the codling moth adult. The nicotine concentration was decidedly more important in influencing effectiveness—the product of concentration times the square root of time giving an approximately constant value for various exposure periods, or K (effectiveness) $= C\sqrt{T} = CT^{.5}$. This relation differed somewhat with the different insects (from $K = CT^{.38}$ to $K = CT^{.64}$) but the general trend was $K = CT^{.5}$. Thus for a four-fold increase in exposure period the nicotine concentration needed would be reduced not by ¼ but by only ½.

Nicotine appeared to be much more toxic to several species of insects than hydrocyanic acid. The weight of nicotine necessary to kill the bean aphid, chrysanthemum aphid, a thrips and the American cockroach was only 1, 1.3, 6, and 8 per cent, respectively, of the weight of hydrocyanic acid needed under quite similar conditions (the values for HCN being those of other workers reported in the literature). On a molecular basis the difference would be six times greater. It is questionable whether these differences would hold under practical conditions because of the great absorption of nicotine by fumigated materials, moisture, and other factors.

The concentration of nicotine obtained in greenhouse fumigations with nicotine products was distinctly higher under dry conditions than under damp conditions. Various methods of nicotine fumigation were tried and it was found that under favorable conditions in the greenhouse the nicotine concentration rises rapidly to a maximum of 25–55% of the dosage in 7–10 minutes; then falls rapidly away to 3–15% at the end of an hour. The highest nicotine concentrations were obtained by (1) the vaporization of nicotine in the exhaust of a gasoline engine and (2) the pressure-can method of vaporization. The very fine atomization of acetone solutions of nicotine gave somewhat lower concentrations. Tobacco powder smudge was next and nicotine-impregnated papers were slightly lower. (Author's abstract.)

Discussion followed by Back, Hawkins, and Muesebeck.

R. E. Snodgrass and H. E. Ewing presented brief notes regarding the poisonous properties of native millipedes.

Adjournment at 10 P. M.

ASHLEY B. GURNEY,
Recording Secretary.

Actual date of publication, October 27, 1938.

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PROCEEDINGS OF THE

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NOTES ON SOME GENERA AND SPECIES OF CHALCIDOIDEA (HYMENOPTERA).

By A. B. GAHAN,
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

These notes, which involve some generic and specific synnonymy, several generic transfers, and some new distributional records for several species, are published at this time in order to make clear the use of the names in identifications furnished to economic workers.

Family CHALCIDIDAE.

Brachymeria femorata (Panzer).

Chalcis femorata Panzer, Faun. Insect. German., VII, p. 84, T. 16, 1801.
Chalcis koebelei Crawford, Proc. Ent. Soc. Wash., vol. II, p. 207, 1910. (New synonymy.)

A specimen from Potsdam, Germany, identified by F. Ruschka as *Chalcis femorata* Panzer has been compared with the type specimens of *C. koebelei* Crawford and seems to be the same. The hind femur of the specimen from Germany has the black transverse band somewhat narrower than do the types of *koebelei*, and the wings slightly infuscated, but there appears to be no structural difference of any kind. The color of the femur is somewhat variable in the material at hand, and the infuscation of the wing is of such a character that it is not believed to be of any specific significance.

Besides the specimen from Germany and the types of *koebelei* which were from Hong Kong, China, the following material of this species has been seen: Two specimens from Hungary collected by Chas. Sajo (these specimens now in the collection of the Illinois State Laboratory of Natural History at Urbana, Ill.); one specimen from Baguio, Philippine Islands, reared from *Pieris* sp. by A. G. Toquero; one specimen from Manila, P. I., collected by R. C. McGregor; one specimen from Kolambugan, Mindanao, P. I.; and one specimen from Buitenzorg, Java, reared from a pupa of a nymphalid by K. W. Dammerman.

This material has been carefully compared with Panzer's original description and figure, and Ruschka's identification of the species seems to be undoubtedly correct.

Family EURYTOMIDAE.

Eurytoma monemae Ruschka.

Eurytoma monemae Ruschka, Ent. Mitt., vol. 7, p. 161, figs. 1–2, 1918.
Eurytoma parasae Gahan, Proc. U. S. Natl. Mus., vol. 56, p. 514, 1919. (New synonymy.)

Two paratypes of *Eurytoma monemae* Ruschka, secured through the kindness of Dr. Walther Horn of the Deutsches Entomologisches Institut, Berlin-Dahlen, Germany, have been compared with the type series of *E. parasae* Gahan and found to agree. Ruschka's specimens were reared from cocoons of *Monema flavescens* Walker collected at Tientsin, China, while the specimens composing the type series of *parasae* were reared from *Parasa lepida* Cram. and *Thosea* sp. in South India.

Eurytoma nesiotes Crawford.

Eurytoma fulvipes Crawford, Proc. U. S. Natl. Mus., vol. 38, p. 129, 1910. (Preoccupied by *fulvipes* Fitch, 1865.)
Eurytoma nesiotes Crawford, Proc. U. S. Natl. Mus., vol. 41, 1911, p. 273. (For *fulvipes* Crawford, not *fulvipes* Fitch, 1865.)
Eurytoma denticoxa Gahan, Proc. U. S. Natl. Mus., vol. 56, p. 515, 1919. (New synonymy.)
Eurytoma dentipectus Gahan, Proc. U. S. Natl. Mus., vol. 56, 516, 1919. (New synonymy.)

The type of *Eurytoma nesiotes* Crawford, described from the Philippines, is apparently not distinguishable from that of *E. denticoxa* Gahan, described from Coimbatore, South India. Likewise a careful restudy of the series of specimens upon which I based the description of *E. dentipectus* has demonstrated that the characters mentioned in the description as distinguishing this species from *denticoxa* are not constant and this species must also be relegated to synonymy with *nesiotes* Crawford.

Family ENCYRTIDAE.

Tachinaephagus zealandicus Ashmead.

Tachinaephagus zealandicus Ashm., Mem. Carnegie Mus., vol. I, p. 304, 1904.
Tachinaephagus australiensis Gir., Ins. Inscit. mens, vol. 5, p. 142, 1917.
Stenoterys fulvoventralis Dodd, *in* Froggatt, Agr. Gaz. N. S. Wales, vol. 32, 1921, p. 730, figs. (New synonymy.)
Australencyrtus giraulti Johnston & Tiegs, Proc. Roy. Soc. Queensland, vol 33, pp. 107, 118, figs. 11–17, 1931. (New synonymy.)

That *Tachinaephagus zealandicus* Ashm. and *T. australiensis* Girault are identical was pointed out by Gahan and Fagan in

the list of type species of the genera of Chalcidoidea (U. S. Natl. Mus. Bull. 124, p. 141, 1923). Both names are based on the same type specimens.

Tachinaephagus giraulti Johnston & Tiegs and *Stenoterys fulvoventralis* Dodd were declared to be identical by Ferrière (Rev. Suisse Zool., vol. 40, p. 637, 1933). Ferrière also stated that *T. giraulti* was very similar to *T. zealandicus* Ashmead but pointed out certain minor details in which they seemed to differ, these supposed differences apparently based on comparison of specimens of *giraulti* with Girault's description of *zealandicus* (= *australiensis*).

I have compared the Ashmead and Girault types of *zealandicus* with specimens reared from blowflies at Brisbane, Australia, by G. H. Hardy and also with a series of specimens reared by D. Miller from *Sarcophaga milleri* Johnston in New Zealand and found them to agree exactly. These specimens have also been compared with the original descriptions of *Australencyrtus giraulti* and *Stenoterys fulvoventralis* and found to agree. The supposed differences doubtfully pointed out by Ferrière are not apparent or are plainly covered by variation. I am quite certain that *giraulti* is a synonym of *zealandicus*.

Family PTEROMALIDAE.

Dibrachys cavus (Walker).

Pteromalus cavus Walker, Ent. Mag., vol. 2, p. 377, 1835.

Pteromalus boucheanus Ratzeburg, Ichneum. d. Forstinsect., vol. 1, p. 196, 1844.

Semiotellus clisiocampae Fitch, 1st and 2d Repts. Ins. New York, p. 200, 1856. (New synonymy.)

Cheiropachys nigrocyaneus Norton, Trans. Amer. Ent. Soc., vol. 2, p. 327, 1869. (New synonymy.)

Pteromalus gelechiae Webster, Rept. State Ent. Ill., 12, p. 151 (1882), 1883. (New synonymy.)

Pteromalus chionobae Howard, Scudder's Butterflies of U. S., p. 1889, 1889. (New synonymy.)

Arthrolytus apatetae Ashmead, Bull. Ohio Expt. Sta., vol. 1, p. 162, 1893. (New synonymy.)

Arthrolytus pimplae Ashmead, Trans. Amer. Ent. Soc., vol. 21, p. 339, 1894. (New synonymy.)

Coelopisthoidea nematicida Gahan, Canad. Ent., vol. 45, p. 179, 1913. (Not *nematicida* Packard.)

Dibrachys apatetae Girault, Canad. Ent. vol. 48, p. 408, 1916.

Dibrachys clisiocampae Girault (in part), Canad. Ent. vol. 48, p. 408, 1916.

In my judgment the above names all refer to the same species. I have compared material in the United States National Museum, including types of *apatelae*, *pimplae*, *nigrocyaneus*, *chionobae*, *gelechiae* and *clisiocampae* with representatives from Europe of

cavus and *boucheanus* and can find no means of distinguishing any of them. In the above-cited paper by Girault, *Pteromalus nematicida* Packard is listed as a synonym of *clisiocampae* Fitch. Girault's conclusion was based upon specimens of *D. cavus* in the United States National Museum labeled "types" of the Packard species but which are certainly not types of the species, as will be shown in the discussion of *Tritneptis klugii* (Ratzeburg) on a subsequent page of this paper. The transfer of *nematicida* Packard to the genus *Coelopisthoidea* by Gahan likewise was based upon the same false "types."

Dibrachys saltans (Ratzeburg).

Pteromalus saltans Ratzeburg, Ichneum. d. Forstinsect., vol. 3, p. 232, 1852.
Coelopisthoidea cladiae Gahan, Canad. Ent., vol. 45, p. 179, 1913. (New synonymy.)
Dibrachys saltans Kurdjumov, Rev. Russ. Ent. vol. 13, p. 11, 1913.

Ratzeburg described this species from Germany as a parasite of *Cladius uncinatus* Hartig. Thomson (Hymen. Scand. vol. 5, p. 157, 1878) doubtfully synonymized it with (*Diglochis*) *Psychophagus omnivorus* (Walk.). Kurdjumov, who had examined Ratzeburg's type, transferred the species to the genus *Dibrachys*.

In 1927 the writer was privileged to study Ratzeburg's collection which is preserved in the Forstliche Hochschule at Eberswalde, Germany, and upon examining the type of *Pteromalus saltans* was immediately impressed with its resemblance to *Coelopisthoidea cladiae* Gahan described in 1913 from specimens reared at Upper Marlboro, Md., from *Cladius isomerus* Norton (= *pectinicornis* of authors, not Fourc.). A paratype of the American parasite was compared with the type of *saltans* and found to be indistinguishable.

Kurdjumov expressed the opinion that *saltans* was probably a variety of *Dibrachys boucheanus* (Ratzeburg). Although congeneric the two species are quite distinct. The head of *saltans* is distinctly thicker antero-posteriorly than that of *boucheanus*, the frons more deeply concave, mandibles larger with their lower basal angles unusually prominent and their ventral margins more or less reflexed, clypeus distinctly incised at the middle, occipital carina present but less strongly developed, pedicel fully three times as long as broad, and second ring joint subquadrate.

Dibrachys saltans is easily distinguished from *Psychophagus omnivorus* by the short and subequal stigmal and postmarginal veins, by the presence of an occipital carina, by the conic ovate abdomen, and by numerous other characters.

Besides the types of *Coelopisthoidea cladiae*, the U. S. National

Museum now possesses 3 specimens of *D. saltans* reared by W. W. Baker from *Cladius isomerus* Norton, July 26, 1933, at Puyallup, Wash., and one specimen said to have been reared by C. N. Ainslie from stems of *Stipa comata* in August, 1923, at Beach, N. Dak.

Tritneptis Girault.

Psyche, vol. 15, p. 92, 1908.

This genus was erected with *Tritneptis hemerocampae* Girault as its genotype. Nine years later Girault (Ins. Inscit. Mens., vol. 12, 1924) synonymized the type species with *Dibrachys boucheanus* Ratzeburg).

Three cotypes as well as numerous other specimens of *T. hemerocampae* are in the U. S. National Museum collection, and an examination of these shows quite plainly that this synonymy is incorrect. *T. hemerocampae* lacks entirely the occipital carina so characteristic of *Dibrachys boucheanus* [now recognized as a synonym of *D. cavus* (Walker)]. The head is more deeply emarginate posteriorly, the cheeks broader, the postmarginal vein usually a little shorter than the stigmal (never slightly longer as in *cavus*), and there are other minor differences which make it very certain that *T. hemerocampae* is a species different from *Dibrachys cavus* and, according to the present definitions of genera in the *Pteromalidae*, it is excluded from *Dibrachys* by the absence of the occipital carina.

The genera of Pteromalidae are very much in need of a thorough revision, and until such a revision is published and the various genera redefined it seems expedient to recognize *Tritneptis* as a good genus very closely resembling *Dibrachys*, but distinguished from it chiefly by the immargined occiput. It apparently differs from *Coelopisthia* Foerster as at present understood only by having the abdomen in the female distinctly much longer than broad instead of nearly circular.

The following key will help to distinguish five species occurring in North America, which I believe belong in *Tritneptis:*

KEY TO THE SPECIES OF TRITNEPTIS OCCURRING IN NORTH AMERICA.

1. Forewing entirely without marginal fringe; head in lateral view with the face not entirely ventral, forming with plane of frons an angle distinctly greater than a right angle; mesoscutum and scutellum dull or only weakly shining, the sculpture not especially shallow; forewings either hyaline or distinctly infuscated. Male scape either slender or distinctly thickened 2

Forewing with a distinct though short marginal fringe along posterior apical border behind apical middle; head in lateral view with the face entirely ventral and forming with the frons almost an exact

right angle; mesoscutum and scutellum shining metallic, the sculpture distinct but very shallow; forewings hyaline. Scape of male distinctly thickened ..... *klugii* (Ratzeburg).

2. Forewing of female with a large deeply fuscous cloud embracing full width of wing and extending from base of wing to a point beyond apex of stigmal vein, this cloud present but less distinct in the male; scutellum very finely and deeply punctate, opaque, this sculpture obviously a little finer than that of mesoscutum; marginal vein distinctly more than twice as long as stigmal; clypeus bright metallic green; mandibles rufous; scape of male slender ..... *scutellata* (Muesebeck).

Forewings in both sexes hyaline; mesoscutum and scutellum less deeply sculptured, slightly shining, the punctures of scutellum a little shallower than those of mesoscutum but not conspicuously finer; marginal vein not more than twice as long as stigmal; clypeus not bright metallic green; mandibles variable in color, often black; scape of male more or less thickened 3

3. Antennal pedicel about twice as long as broad, equal to or very little longer than the first funicle joint plus the two ring joints; postmarginal vein as long as or slightly longer than stigmal; forewing behind submarginal vein either bare or with numerous weak cilia, behind and adjacent to the marginal vein not more sparsely ciliated than on middle of wing; mandibles often yellowish but sometimes black 4

Antennal pedicel three times as long as broad, equal to or only very slightly shorter than the combined first and second funicle joints plus the ring joints; postmarginal vein a little shorter than stigmal; base of wing behind the submarginal vein bare, behind and adjacent to the marginal vein more sparsely ciliated than on middle of wing; mandibles black ..... *hemerocampae* (Girault).

4. Forewing behind submarginal vein bare; lateral folds of propodeum cariniform; anterior margin of clypeus straight; mandibles reddish testaceous ..... *koebelei*, new species.

Forewing behind submarginal vein with numerous weak discal cilia; lateral folds of propodeum distinct but rounded, not cariniform; anterior margin of clypeus sinuate, slightly impressed at the middle so as to form two short teeth or projections; mandibles dark ferruginous to black ..... *diprionis*, new species.

Tritneptis klugii (Ratzeburg), new combination.

Pteromalus klugii Ratzeburg, Ichneum. d. Forstinsect., vol. 1, p. 198, 1844.

Pteromalus nematicida Packard, Rept. U. S. Commr. Agr., p. 146, pl. 13, fig. 5, 1883. (New synonymy.)

Coetopisthia nematicida Hewitt, Canad. Ent., vol. 43, p. 298, figs. 19–23, 1911; Canad. Expt. Farms Ent. Bull. 5, p. 28, figs. 15–18, 1912.

Diglochis sp. Ruggles, Jour. Econ. Ent., vol. 4, p. 171, 1911; Hewitt, Canad. Expt. Farms Bull. 5, p. 31, 1912.

Lariophagus klugii Kurdjumov, Rev. Russ. Ent., vol. 13, p. 15, 1913.

Diglochis lophyrorum Ruschka, Zeitschr. Angew. Ent., Bd. II, Heft. 2, p. 400, 1915; Meyer, Biol. Meth. Pest Control, Leningrad, p. 114, 1931. (New synonymy.)

Several series of specimens reared from the larch sawfly (*Nematus erichsonii* Hartig) in America have been compared with the description of *Pteromalus klugii* Ratzeburg, originally recorded from the same host species in Germany, and seem to agree perfectly. Furthermore these specimens apparently agree in every detail with the description of *Diglochis lophyrorum* Ruschka, originally described as a parasite of *Lophyrus pini* (L.) in Bohemia. No European specimens are available for comparison but the agreement of the American material with both descriptions, taken in conjunction with the host records, leaves no reason to doubt that the parasite occurring in America is really the European species and that *Pteromalus klugii* and *Diglochis lophyrorum* are identical.

Pteromalus nematicida Packard is believed to be identical with *klugii* Ratzeburg. No type material of *nematicida* has been available for study and the conclusion regarding its identity therefore is necessarily based on the description and host record. Four specimens in the National Museum collection, labeled as types of *nematicida* and so recorded in the type catalog, could not have been part of the type series since, according to the labeling, they were reared in Illinois by D. W. Coquillet, from *Nematus ventricosus* Latrielle (now treated as a synonym of *N. ribesii* Scopoli), whereas the actual types of the species were reared by Packard from cocoons of *Nematus erichsonii* Hartig collected in Maine by C. G. Atkins. These false "types" appear to be typical *Dibrachys cavus* (Walker), and, as I have pointed out in the discussion of that species, they were the basis of Girault's as well as my own previous treatment of the species. Packard's original characterization of *nematicida* consisted merely of a figure of the adult coupled with the host record. This figure agrees fairly well with the specimens which I have identified as *klugii*. Through the kindness of Mr. G. Stuart Walley of the Canadian Department of Agriculture I have received a number of specimens of the parasite treated of by G. Gordon Hewitt under the name of *Coelopisthia nematicida* and find them to agree in every respect with what I am calling *klugii*. Unfortunately I have been unable to obtain representatives of the parasite referred to by Ruggles under the name of *Diglochis* sp. According to Hewitt, specimens obtained by him from Ruggles were submitted to C. T. Brues, who informed him that they agreed well with *Pteromalus klugii* Ratzeburg. Since *klugii*, as will be shown, is present in Minnesota, there appears no reason to doubt that the *Diglochis* sp. of Ruggles was in reality *klugii*.

Pteromalus klugii was transferred to the genus *Lariophagus* Crawford by Kurdjumov, probably on the basis of an examination of Ratzeburg's types. The species is similar in many respects to the genotype of *Lariophagus* (*L. texanus* Crawford) but differs by having the eyes inconspicuously hairy, the face much more strongly receding below the antennae, the postmarginal and stigmal veins shorter and subequal [about as in *Dibrachys cavus* (Walker)], and the antennal pedicel much longer than the first funicle joint plus the ring joints. These characters as well as the different host relationships indicate that the species does not belong in *Lariophagus*. Neither does it fall naturally in the genus *Diglochis*. The head is quite differently shaped from that of *D. complanatus* (Ratzeburg). The antennal flagellum is much more slender, the eyes are not nearly so hairy, the stigmal and postmarginal veins are shorter, the propodeal spiracles are more nearly circular, and the female abdomen, instead of being subcircular in outline and shorter than the thorax, is as long as the head and thorax or longer, elongate ovate in outline, and fully twice as long as broad.

The venation, shape of the abdomen, and most of the other characters agree very closely with those of the genus *Dibrachys* Foerster, but the absence of any semblance of an occipital carina at once excludes the species from that genus. Many of its characters ally it closely with those species at present placed in the genus *Coelopisthia* Foerster, but the elongate-ovate abdomen is unlike typical species of that genus which have the abdomen short and broad.

On the other hand *Pteromalus klugii* seems to be entirely congeneric with *Tritneptis hemerocampae* Girault, genotype of *Tritneptis* Girault, and the species should therefore be known as *Tritneptis klugii* (Ratzeburg).

The following series of specimens in the National Museum collection all appear to be *Tritneptis klugii:* 3 specimens from *Nematus erichsonii* collected in Chequamegon National Forest, Wis., February 1936, under North East Forest Laboratory No. 14–201; 10 specimens from the same host species taken in the Flathead National Forest, Mont., March 4, 1936, under the same laboratory number; 14 specimens from *N. erichsonii* taken at Clarissa, Minn., September 7, 1931, by L. W. Orr; 12 specimens from *N. erichsonii* taken in Blackfeet National Forest, Mont., September 28, 1935, by J. C. Evenden, Hopk. U. S. No. 20125; 4 specimens from *Neodiprion tsugae* Middleton, Sweet Home, Ore., September 7, 1935, collected by R. L. Furniss Hopk. U. S. No. 31660D; 4 specimens from the same host and locality, July 1, 1935, under Hopk. U. S. No. 31607–237; 5 specimens from unnamed host on *Tsuga heterophylla* collected at Sweet Home, Oreg., August 18, 1934, J. A. Beal collector, under Hopk. U. S. No. 18875D; 8 specimens from West Yellow-

stone, Mont., September 9, 1924, J. C. Evenden collector, under Hopk. U. S. No. 17234a, host not indicated; 19 specimens from *Neodiprion banksiana* Rohwer, August 2, 1923, S. A. Graham collector, Hopk. U. S. No. 17500g, locality not indicated; 28 specimens from sawfly on lodgepole pine, West Yellowstone, Mont., August 28, 1926, H. E. Burke collector, Hopk. U. S. No. 18088g; 12 specimens from Cascade, Idaho, on *Pinus murrayana*, September 10, 1924, J. C. Evenden collector, Hopk. U. S. No. 17204a; 160 specimens from Fernis, British Columbia, reared from *N. erichsonii*, and received from the Canadian Department of Agriculture.

Tritneptis scutellata (Muesebeck), new combination.

Coelopisthia scutellata Muesebeck, Jour. Agr. Research, vol. 34, No. 4, p. 331, 1927.

Tritneptis hemerocampae Girault.

Tritneptis hemerocampae Girault, Psyche, vol. 15, p. 92, 1908.
Coelopisthia diacrisiae Crawford, Proc. Ent. Soc. Wash., vol. 12, p. 145, 1910. (New synonymy.)

I am unable to find any character which will distinguish cotypes of *Tritneptis hemerocampae* in the U. S. National Museum collection from the holotype and paratypes of *Coelopisthia diacrisiae* in the same collection. The specimens constituting the type series of *diacrisiae* are slightly larger than typical specimens of *hemerocampae* but do not differ otherwise. I believe they are the same species.

Tritneptis diprionis, new species.

This apparently new species is very similar to *hemerocampae* (Gir.) and one small series of specimens of it was previously identified by me as that species. It differs from *hemerocampae*, however, by the characters set forth in the accompanying key to species and also by the costal cell of the forewing being slightly more hairy, and the frons a little less deeply impressed medially. The male may be distinguished from *hemerocampae* by the thicker antennal scape.

Female.—Length 2.4 mm. Head and thorax with rather shallow alveolate sculpture. Head in dorsal view a little broader than thorax at tegulae, moderately concave posteriorly; frons broad, shallowly impressed medially; postocellar line slightly longer than ocellocular line; head in front view distinctly broader than high, antennae inserted about on a line with lower extremities of eyes; face moderately receding below antennae, forming with the plane of frons a rounded angle much greater than a right angle; clypeus slightly produced, its

anterior margin slightly sinuate; antennae moderately clavate; scape subcylindrical, not quite reaching to the front ocellus; pedicel about equal in length to the two ring joints plus the first funicle joint, frequently a little longer or a little shorter; first ring joint small and transverse, second subquadrate; first funicle joint very slightly longer than broad, following joints successively a little shorter, the fifth and sixth usually slightly broader than long; club a little longer than the two preceding funicle joints combined, distinctly a little thicker than the funicle; eyes with obscure, very short, sparse pile. Mesoscutum broader than long, shallowly sculptured, slightly shining, the parapsidal grooves weakly impressed anteriorly, absent posteriorly; scutellum rather flat, a little more finely and shallowly sculptured than the mesoscutum; propodeum about half as long as scutellum, distinctly more deeply sculptured than scutellum, with a distinct and complete median carina, the lateral folds also complete and distinct but not sharply cariniform. Forewing reaching considerably beyond apex of abdomen; marginal vein about twice as long as stigmal, the postmarginal vein equal to or very slightly longer than stigmal; forewing without marginal cilia, the discal area behind submarginal vein not bare as in *hemerocampae* but with numerous rather weak cilia and the area adjacent to the marginal vein fully as densely ciliated as the rest of the wing; hind wing with weak marginal cilia and nearly uniformly distributed discal cilia. Legs normal; hind tibia with one distinct spur. Abdomen as long as the thorax, broadly ovate, usually broader than the thorax, smooth or practically so, the last two segments very weakly sculptured; ovipositor not exserted. Head and thorax blackish green with a faint metallic luster; scutellum usually with a faint purplish tinge; propodeum dark greenish; abdomen shining black; scape dark reddish testaceous; pedicel either blackish or testaceous; flagellum black; coxae concolorous with thorax, rest of legs dark reddish testaceous; wings hyaline, venation dark brown.

Male.—Length 1.9 mm. Exactly like the female except that the antennal scape is obviously a little thickened, and the abdomen, while broadly ovate, is more rounded at apex.

Type locality.—Bound Brook, N. J.

Type.—U. S. N. M. No. 52891.

Described from 7 females and 1 male, reared from *Neodiprion sertifer* (Geoffroy), August 2, 1937, at Bound Brook, N. J. under North East Forest Laboratory No. 25–203–37; 4 females and 3 males reared from an unidentified sawfly on Norway pine taken at Springfield, Maine, August 31, 1932; 4 females and 3 males from an unidentified tenthredinid taken at Groton, Mass., September 1, 1936, under North East Forest Insect Laboratory No. 164–205–36–3; and 6 females and 1 male reared from cocoons of "black-headed spruce sawfly" taken at Itasca Park, Minn., July 27, 1930, by L. W. Orr.

Tritneptis koebelei, new species.

Agreeing with the description of *Tritneptis diprionis*, new species, except in the following particulars:

Female.—Length 1.8 mm. Eyes apparently entirely bare; anterior margin of clypeus straight, without an impression at middle; fifth and sixth joints of funicle quadrate; forewing behind the submarginal vein and basad of the point where the vein curves forward to join the marginal vein bare or practically so, occasionally with a very few vestigial cilia; lateral folds of the propodeum sharply defined, the edge of the fold more or less cariniform; abdomen about as long as combined head and thorax, brownish black; antennal pedicel testaceous like the scape, flagellum brownish black; mandibles testaceous; scutellum not tinged with purple.

Male.—Length 1.65 mm. Like the male of *diprionis* except for the characters indicated in the key, and the fact that the antennal flagellum is pale brownish in color, the scape very pale yellowish.

Type locality.—Natoma, Sacramento County, Calif.

Type.—U. S. N. M. No. 52892.

Described from 18 females and 2 males, reared by Albert Koebele in January, 1888,? from cocoons of what was in all probability *Caliroa cerasi* (L.) feeding on pear at Natoma, Calif., and recorded under Bureau of Entomology note No. 69°. Several of the specimens in the type series are rather badly broken but a few are complete.

CHEIROPACHUS Westwood.

Tropidogastra Ashmead, Mem. Carnegie Mus., vol. 1, 1904, p. 223. (New synonymy).

Tropidogastra was described by Ashmead in a generic key and *T. arizonensis* Ashmead cited as the type species. Examination of the type specimen of *arizonensis* has shown that it agrees in all essential generic characters with the type species of *Cheiropachus*, *C. colon* (L.), and hence *Tropidogastra* should be considered a synonym of *Cheiropachus*.

The following key will help in the recognition of the three species of *Cheiropachus* thus far known from North America.

Key to the North American Species of Cheiropachus.

1. Females 2
   Males 4
2. Forewing with two large fuscous spots or incomplete bands, one at the apex of submarginal vein, the other adjacent to the postmarginal vein; front femora usually with a distinct notch in its ventral margin near apex 3
   Forewing hyaline or with only an obscure fuscous band across the angle formed by postmarginal and stigmal veins, rarely with a slight discoloration at the apex of submarginal vein; front femora greatly swollen but its ventral margin without a notch before the apex ..... *arizonensis* (Ashmead).
3. Propodeum between the spiracles weakly sculptured, usually without

definite alveolae; frons laterad of the scrobes with shallow alveolate sculpture ..... *colon* (Linnaeus).

Propodeum between the spiracles more strongly sculptured, this sculpture taking the form of rather definite alveolate punctures; frons laterad of scrobes more deeply and irregularly alveolate ..... *brunneri* Crawford.

4. Marginal vein very slightly longer than stigmal; front femur usually with a distinct notch in its ventral margin near apex 5

Marginal vein one and one-half to two times as long as stigmal; front femur without a notch in ventral margin; legs including all coxae reddish testaceous; forewings with two conspicuous fuscous bands ..... *arizonensis* (Ashmead).

5. Propodeum without definite alveolate sculpture; legs, including all coxae, mostly reddish testaceous ..... *colon* (Linnaeus).

Propodeum with definite alveolate sculpture; legs, including all coxae, brownish black ..... *brunneri* Crawford.

Cheiropachus arizonensis (Ashmead), new combination.

Tropidogastra arizonensis Ashmead, Mem. Carnegie Mus., vol. 1, p. 323, 1904.
Dinarmus arizonicus Girault, Ins. Inscit. Mens., vol. 4, p. 109, 1916.

The type of *Tropidogastra arizonensis* is a female specimen collected by Hubbard and Schwarz in the Santa Rita Mountains, Ariz., June 19, 1898. The only description of it by Ashmead is that given in the generic key. The same specimen was redescribed by Girault under the name *Dinarmus arizonicus*.

It differs from *Dinarmus*, however, by having six instead of five joints in the funicle, by having the anterior and posterior femora much more swollen, and by having the posterior margin of the pronotum much more deeply concave. The generic characters ally it unmistakably with *Cheiropachus colon* (L.) and the species is therefore transferred to *Cheiropachus*.

Besides the type specimen there are now in the collection of the United States National Museum the following specimens which I have assigned to the species *arizonensis:* 7 females and 7 males from Dallas, Tex., reared from red cedar by F. C. Bishopp and bearing Hopk. U. S. No. 9929q–2; 6 females and 3 males reared at Dallas, Tex., April, 1922, from ? *Phloesinus* in red cedar, also by F. C. Bishopp; 5 specimens from Alturas, Calif., reared by F. P. Keen from *Juniperus occidentalis*, June 27, 1929, under Hopk. U. S. No. 18164–C, and 2 specimens from the same locality, reared by the same collector from *Cercocarpus ledifolius*, June 26, 1929, under Hopk. U. S. No. 18154–C; 4 specimens from Terrebonne, Oreg., reared from *Juniperus occidentalis*, August 20, 1930, by F. P. Keen under Hopk. U. S. No. 18199–b; 8 specimens from Princeville, Oreg., reared from *Phloesinus* sp. in *Juniperus*, by W. J. Buchhorn under Hopk. U. S. Nos. 18972–C and 18976–C; and 6 specimens from Bandolier, N.

Mex., reared from *Juniperus*, December 21, 1934, by D. De Leon under Cage No. 447.

In the male sex this species greatly resembles the males of *colon* and can be distinguished only by the absence of any notch on the ventral margin of the front femora and by the relatively longer marginal vein. The forewings are banded precisely as in *colon*. The females may have the forewings entirely hyaline or there may be a slight infuscation at the base of postmarginal vein.

TOMICOBIA Ashmead.

Tomicobia Ashmead, Proc. Ent. Soc. Wash., vol. 4, p. 203, 1899; Mem. Carnegie Mus., vol. 1, p. 283, 1904.

Ipocoelius Ruschka, Ent. Tidskr., H. 1, p. 6, 1924. (New synonymy.)

Tomicobia was first described by Ashmead in a key to genera of Cleonymidae but without inclusion of any species. In his Classification of the Chalcid-flies of the Superfamily Chalcidoidea (1904) Ashmead again included it in his key to the genera of Cleonymidae and named as the genotype *T. tibialis* Ashmead but gave no description of the species other than that contained in the generic key. Apparently the only other reference to the species in literature is a short note by A. D. Hopkins (Proc. Ent. Soc. Wash., vol. 15, 1913, p. 160) stating that it is parasitic upon adult scolytid beetles of the genus *Ips*. One undated specimen in the United States National Museum reared by Hopkins in West Virginia and bearing his No. 7188b is labeled type.

Ipocoelius was described by Ruschka in the tribe Pteromalini with two included species, viz, *I. seitneri* Ruschka, a parasite of *Ips typographus* (L.) in Sweden, Austria, and Bavaria, and *I. rotundiventris* Ruschka, parasitic upon *Otiorhynchus ligustici* (L.) in Sweden. Both species were said to attack their hosts in the adult stage. Two paratypes of *I. seitneri* are in the U. S. National Museum, obtained through an exchange with the Naturhistorischen Museum in Vienna.

The type of *Tomicobia tibialis* and the paratypes of *Ipocoelius seitneri* were recently compared and found to be undoubtedly congeneric. The two species are extremely similar. I am able to distinguish them only by the fact that in *seitneri* the postmarginal vein is about one and one-half times as long as the stigmal while in *tibialis* the postmarginal is not more than one and one-fourth times the length of the stigmal. In other respects they appear to be exactly alike.

Several specimens reared by D. De Leon from *Ips oregoni* (Eichh.) on lodgepole pine at Coeur d'Alene, Idaho, in May, 1929, under Hopkins U. S. No. 19744 were identified by the writer as *Ipocoelius*, n. sp. Additional specimens were sub-

sequently received from the same locality, reared from the same host by H. J. Rust in June, 1932, and April, 1933, under Hopkins U. S. No. 19994. More recently one specimen reared from *Ips confusus* (Lec.) in Sequoia National Park, Calif., November 4, 1934, and another taken on *Pinus ponderosa* in the same locality were sent in by L. F. Cook, and there are five additional specimens in the National Museum collection taken at Asheville, N. C., October 7, 1925, by A. H. MacAndrews. I am unable to distinguish more than one species in all this material and believe it all to be referable to *Tomicobia tibialis* Ashmead.

As represented by this series of 23 specimens, *Tomicobia tibialis* shows considerable variation both in minor details of structure and in color. The funicle joints are usually subquadrate but may be somewhat longer than broad. The propodeum may have a complete though weak median longitudinal carina or this carina may be entirely lacking. The scape in some cases is yellowish testaceous but often almost wholly dark brown. The legs vary from wholly brownish black, except the tarsi, which are always more or less testaceous, to largely reddish testaceous with only the coxae black and the femora dark brown. Head and thorax with fine, shallow alveolate sculpture; propodeum between the spiracles more deeply sculptured, laterad of spiracles nearly smooth; spiracles short elliptical; abdomen smooth, ovate, about as long as thorax, with a prominent hypopygium which extends to the apex of abdomen. Face dark metallic green; rest of head, thorax and abdomen greenish black with a slight aeneous tint. Wings hyaline, venation brownish testaceous. Flagellum black.

Amblymerus verditor (Norton).

Platyterma ecksteinii Wolff, Zeitschr. f. Angew. Ent., vol. 3, p. 168, 1916. (New synonymy.)

A specimen of *Platyterma ecksteinii* Wolff, obtained through an exchange with the Naturhistorisches Museum of Vienna, has been compared with the type and other American material of *Amblymerus verditor* (Norton) and found to agree exactly. Wolff's species, which is said to parasitize *Lophyrus pini* L., is to be considered a synonym of *verditor* (Norton).

HETEROSCHEMA Gahan.

Proc. U. S. Natl. Mus., vol. 55, p. 126, 1919.

This genus resembles *Psilocera* Walker but differs by having three subequal ring joints instead of two in the antennae, the flagellum more nearly cylindrical instead of strongly incrassated toward apex, the anterior margin of clypeus squarely truncate or weakly bidentate instead of strongly bidentate, and the

hypopygium never extending to the apex of abdomen. It is also similar to *Toxeumella* Girault, from which it differs by having the clypeus much less prominent, the cheeks not hollowed out at the base of mandibles, the ocellocular line shorter than the postocellar line or at least not longer, and the head much more strongly transverse. It is probably closest to *Eurydinoteloides* Girault, from which it may be distinguished by the immargined occiput, by the shorter abdomen, which is rarely a little longer than the combined head and thorax, and by the incomplete parapsidal grooves.

Heteroschema rugosopunctata (Ashmead), new combination.

Pteromalus rugosopunctatus Ashmead, Jour. Linn. Soc. London, Zool., vol. 25, p. 165, 1894; Dalla Torre, Cat. Hymen., vol. 5, p. 146, 1898; Ashmead, Trans. Ent. Soc. Lond., p. 343, 1900.

Heteroschema prima Gahan, Proc. U. S. Natl. Mus., vol. 55, p. 126, 1919. (New synonymy.)

Pteromalus rugosopunctatus was described from specimens collected on the islands of St. Vincent and Grenada. Paratypes of the species which are in the U. S. National Museum have been compared with the types of *Heteroschema prima*, type species of *Heteroschema* Gahan, and found to agree apparently in every respect. *H. prima* was originally reared at Tempe, Ariz., from *Agromyza gibsoni* Malloch and has been known only from the type specimens. The writer was led to make the comparison of types of *P. rugosopunctatus* and *H. prima* by receipt of a single specimen reared from a flowerhead of *Helianthus* at Santiago de Las Vegas, Cuba, by S. C. Bruner. This specimen was first recognized as *Heteroschema prima* and a later search of the collection of West Indian Hymenoptera showed it to agree also with *Pteromalus rugosopunctatus*. Subsequently two additional specimens reared at Santiago de las Vegas, Cuba, by L. C. Scaramuzza in 1937 from a dipterous pupa were identified as this species. Two specimens received from C. H. Ballou, taken on *Ipomoea tiliacea* at San Pedro de Oca, Costa Rica, also appear to be *rugosopunctatus*.

Heteroschema punctata (Ashmead), new combination.

Glyphe punctata Ashmead, Jour. Linn. Soc. London, Zool., vol. 25, p. 162, 1894.

Gastrancistrus punctatus Dalla Torre, Cat. Hymen., vol. 5, p. 204, 1898.

? *Glyphe punctata* Ashmead, Trans. Ent. Soc. Lond., p. 344, 1900.

Paratypes of *Glyphe punctata* in the National Museum collection do not belong in the genus *Gastrancistrus* Westwood, of which *Glyphe* Walker is a synonym. Instead they are congeneric, in my opinion, with *Heteroschema rugosopunctata* (Ashmead), which, as I have just shown, is identical with the type species of *Heteroschema* Gahan.

(*Glyphe*) *Heteroschema punctata* was originally described from the islands of St. Vincent and Grenada. I have received two specimens of it reared by S. C. Bruner at Santiago de Las Vegas, Cuba, August 4, 1933, from *Helianthus* heads. Other specimens in the collection, which I have identified as this species, are as follows: Five specimens from Cocoa, Fla., March 18, 1930, on *Melanthera niver* (L.), Conner coll.; five specimens from St. Louis, Mo., reared in June, 1928, from an unidentified insect on *Helianthus pitcheriana*, by A. F. Satterthwaite; and two specimens from St. Louis, Mo., reared in July, 1930, from *Agromyza virens* Loew, infesting *Heliopsis*, by A. F. Satterthwaite.

This species is similar to *Heteroschema rugosopunctata* (Ashmead) but may be distinguished at once by its darker legs and by the abdomen, which is a little longer than the head and thorax, strongly compressed, its anterior ventral angle prolonged forward under the thorax to reach the front coxae, the hypopygium prominent but not attaining the apex of the abdomen. The legs are black, with the bases and apices of tibiae narrowly and the tarsi, except the apical joint, pale.

PSEUDOMICROMELUS Gahan and Fagan.

Pseudomicromelus Gahan and Fagan, U. S. Natl. Mus. Bull. 124, p. 124, 1923.
Micromelus Dalla Torre, Cat. Hymen., vol. 5, p. 184, 1898. (Not *Micromelus* Walker.)

This generic name was proposed in the Catalog of type species of the genera of Chalcidoidea for *Micromelus* Dalla Torre, not Walker, Dalla Torre having listed *Micromelus* both as a synonym of *Baeotomus* (p. 89) and as a good genus (p. 184). *Baetomus* Foerster and *Micromelus* Walker were both shown to be synonyms of *Callitula* Spinola, the three genera having the same species as genotype, viz, *Callitula bicolor* Spinola (= *Micromelus rufomaculatus* Walker). *Micromelus silanus* Walker was named as the type species of *Pseudomicromelus*.

At the time the generic name was proposed the genotype species of *Pseudomicromelus* was unknown to the writer except by the description, but it has since been studied. The type of *silanus* is a female in the British Museum general collection in good condition except that the antennae are partly missing.

This type is a pteromalid congeneric with *Pteromalus deplanatus* Nees and very closely resembling that species. The following incomplete notes on Walker's type were made at the time it was examined:

Head viewed from in front narrowed below the eyes, subtriangular; antennae inserted below the eyes, very near the

clypeus; antennae with three very small ring joints, the funicle therefore five-jointed; pronotum short; parapsidal grooves extending to middle of mesoscutum but very delicately impressed; propodeum short, with distinct median carina and complete lateral folds; abdomen circular, a little broader than long; stigmal and postmarginal veins equal or very nearly so, and each approximately half as long as marginal.

Pseudomicromelus silanus (Walker).

Micromelus silanus Walker, Ann. & Mag. Nat. Hist., vol. 12, p. 46, 1843.
Micromelus silvanus Dalla Torre, Cat. Hymen., vol. V, p. 184, 1898.
Pseudomicromelus silvanus Gahan & Fagan, U. S. Natl. Mus. Bull. 124, p. 89, 1923.

The name of this species was changed by Dalla Torre from *silanus* to *silvanus*. Whether this was intentional or a typographical error is not apparent. Dalla Torre's spelling of the name was also used by Gahan and Fagan in the catalog of type species of Chalcidoidea.

The type was collected, according to Walker, at Mount Wellington, in Tasmania, by C. Darwin.

Pseudomicromelus australia (Girault), new combination.

Dibrachys australia Girault, Ins. Inscit. Mems., vol. 5, p. 145, 1917.

The types of this species are in the U. S. National Museum and are strictly congeneric with *silanus* Walker. They appear to agree with the foregoing notes on *silanus* as well as with Walker's description except that the marginal vein is less than twice as long as the stigmal vein and the abdomen is a little longer than broad. Antennae short, moderately clavate, gradually increasing in thickness from pedicel to club, third antennal joint very small, fourth and fifth broader but strongly transverse, the latter nearly as broad as sixth or first true funicle joint, which is also transverse but distinctly longer than the fifth; seventh, eighth, and ninth joints slightly broader than long, the tenth subquadrate; club not much thicker than the last funicle joint and nearly as long as the four preceding joints combined.

This species does not resemble a *Dibrachys* and is excluded from that genus by the absence of any marginal carina on the occiput, by the short subcircular abdomen, and by antennal characters.

The types were reared from *Carpocapsa pomonella* (L.) at Glen Innes, New South Wales.

Pseudomicromelus deplanatus (Nees).

Pteromalus deplanatus Nees, Hymen. Ichneum. Affin. Monogr., vol. 2, p. 110, 1834.

Pteromalus domesticus Walker, Ent. Mag., vol. 2, p. 481, 1835.

Pseudomicromelus deplanatus Keifer & Jones, Calif., Dept. Agr. Mo. Bull., vol. 22, p. 388, 1933.

This common European species does not belong in the genus *Pteromalus* but has apparently been allowed to remain there because it did not seem to fit into any other described genus. Eight specimens obtained through the late Dr. James Waterston and determined by him are, in the writer's opinion, congeneric with *silanus* Walker. The only respect in which they differ that could in any way be considered generic is the fact that in *silanus* the antennal sockets are separated from the posterior margin of the clypeus by a distance scarcely greater than the diameter of a socket, and in *deplanatus* they are a little farther above the clypeus, although on or below a line connecting the lower extremities of the eyes. The marginal vein in *deplanatus* is shorter in proportion to the length of the stigmal vein than in *silanus* but this difference is so slight as to be of little generic significance.

It is possible that *deplanatus* may eventually be found to fall in some earlier proposed genus, in which case *Pseudomicromelus* will become a synonym. For the present it can very well rest in *Pseudomicromelus*.

The Waterston-determined specimens were compared by the writer with specimens in the Ratzeburg collection at Eberswalde, Germany, and found to agree with Ratzeburg's determination of *deplanatus*. The types of Walker's *Pteromalus domesticus* in the British Museum were also found to agree perfectly with *deplanatus*, as did specimens in the Deutches Entomologisches Museum identified as *P. domesticus* by Ruschka. *P. domesticus* has been recognized as a synonym by various European writers.

Pseudomicromelus deplanatus is apparently a common species in Europe and has been frequently mentioned as a parasite of *Tortrix viridana* (L.). It was originally recorded by Nees as a parasite of another tortricid, viz, *Loxotaenia xylosteana* (L.).

The writer received a series of 17 specimens reared in May, 1932, by H. H. Keifer at Marysville, Calif., from *Anarsia lineatella* Zeller which agree perfectly with the specimens from England. My identification of the parasite using the new generic combination was published by Keifer and Jones in 1933. The species had not previously been known to occur in America. *Anarsia lineatella* is known to occur in Europe but apparently it has not been recorded as a host to *deplanatus* there. How the parasite became established in California is not known.

Halticoptera stella Girault.

Halticoptera stella Girault, Descriptiones Hymenopterorum Chalcidoidicarum Variorum cum Observationibus, vol. 3, 1917 (May), p. 1.
Megorismus poloni Girault, Psyche, vol. 24, p. 27 (June, 1917). (New synonymy).

Both of the above names were based upon specimens collected in August in Placer County, Calif., and evidently all originally formed one series. A comparison of the types fails to show any differences between them.

This species is very similar to *Halticoptera aenea* (Walker), but may be distinguished by the less metallic color of the head and thorax and the darker colored legs, all of the femora being black and the tibiae very dark brown or blackish. The malar space is longer than in *aenea* and the lateral angles of the pronotum, viewed from above, are distinctly more prominent.

Family EULOPHIDAE.

MELITTOBIA Westwood.

Melittobia Westwood, Trans. Ent. Soc. Lond., vol. 5, Proc., p. xviii and p. lxv, 1847.
Aceratoneuromyia Girault, Ins. Insc. Mens., vol. 5, p. 151, 1917. (New synonymy.)

Aceratoneuromyia australia Girault, type of the genus *Aceratoneuromyia*, as shown beyond, is a synonym of *Melittobia indicum* Silvestri. Hence the Girault genus is a synonym of *Melittobia*.

Melittobia indicum (Silvestri).

Syntomosphyrum indicum Silvestri, Boll. Lab. Zool. R. Scuola Agr. Portici, vol. 4, p. 232, 1910.
Melittobia indicum Kurdjumov, Rev. Russe d'Entom., vol. 13, p. 245, 1913.
Aceratoneuromyia australia Girault, Ins. Insc. Mens., vol. 5, p. 151, 1917. (New synonymy.)

I have compared cotypes of *Melittobia indicum* Silvestri in the United States National Museum collection with the type material of *Aceratoneuromyia australia* Girault in the same collection and find the two series of specimens to agree in every respect. According to Silvestri the species was introduced from India into western Australia, whence came the type material of the Girault species.

THE LORAL PLATES AND THE HYPOPHARYNX OF HEMIPTERA.

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After many years of investigation and discussion on the morphology of the hemipterous head and mouth parts, two features have remained without a satisfactory explanation. It must be understood, of course, that a "satisfactory explanation" in this case is one that shows how the parts in question correspond with generalized structures in the head of orthopteroid insects. One of the problematical points in the morphology of the hemipterous head is the nature of the sclerites lying at the sides of the clypeus, known as the lora, juga, paraclypeal lobes, or mandibular plates, on which the protractor muscles of the mandibles are attached; the other is the homology of these muscles themselves. The lora, as the plates in question are termed by homopterists, have been referred by different writers to the mandibles, to the genae, and to the clypeus. Two recent papers appearing almost at the same time, one by Spooner (April, 1938), the other by Evans (May, 1938), take up the question of the nature of the lora, and, by a further coincidence, the two authors arrive independently at the same conclusion, namely, that the lora are secondarily detached parts of the postclypeus. Neither writer, however, gives due consideration to the facts that the lower ends of the lora are directly continuous beneath the anteclypeus with the body of the hypopharynx, and that their lateral areas give attachment to the protractor muscles of the mandibles. These two constant features of the lora constitute an anatomical condition quite incompatible with the idea that the loral plates are primarily parts of the clypeus. Though sclerites on which mandibular muscles are normally attached may be supposed to have united secondarily with the clypeal margins, there is no precedent in insect anatomy for the origin of mandibular muscles on any part of the clypeus. Sclerites having the anatomical relations of the hemipterous lora, excepting the clypeal connections, are to be found among insects with biting mouth parts only in the lateral sclerites of the hypopharynx itself that give attachment to the hypopharyngeal muscles of the mandibles.

The basic structure of the hemipterous head is best exemplified in the hypognathous, or auchenorrhynchous, Homoptera (Pl. 22, A, B, C). The clypeus in this group is usually subdivided into a large, protuberant postclypeus (A, *Plcp*), on which the dilator muscles of the sucking pump take their origin, and into a smaller anteclypeus, or clypeolus (*Aclp*), which supports the Labrum (*Lm*), and bears on its inner, or epipharyngeal,

surface the plunger of the pump (H, I, *i*). In some forms, as in the Fulgoridae (B, C), the clypeus is a smaller, more ventral plate, and is not distinctly divided between its postclypeal and anteclypeal areas. Lying immediately laterad of the clypeal margins are the lora (A, B, *Lor*), and behind the lora are the so-called maxillary plates (*MxPl*). Deeply inflected between the lorum and the maxillary plate on each side is the protractor arm of the mandible (E, K, *pa*), which articulates dorsally with the posterior lateral margin of the lorum (*k*), and gives insertion to the protractor muscles of the mandible (*mdpr*) arising on the inner face of the lorum (*Lor*). The retractor arm of the mandible (*ra*) extends up the lateral wall of the bristle pouch and gives attachment to retractor muscles (*mdr*) arising on the vertex.

The loral plates, when fully exposed by removing the anteclypeus from the head, are seen to be directly continuous ventrally with the sides of the hypopharynx (E, F, *Lor*). Their upper parts are always attached anteriorly to the lateral margins of the postclypeus, and usually the lines of attachment are evident as grooves formed by the inflected clypeal margins (E, F, *g*). In some forms, however, as in certain Fulgoridae among the Homoptera (C), the Peloridiidae (D), and in all Heteroptera, the upper parts of the lora are entirely fused with the postclypeus, so that the exposed areas of the loral plates (*Lor*) appear as lateral lobes of the postclypeus. The condition of continuity between the postclypeus and the lora is taken by Spooner (1938) and by Evans (1938) to represent the more generalized structure, and is given as evidence that the lora have been derived by a secondary separation from the postclypeus. This conclusion involves the assumption that the protractor muscles of the mandibles primarily had their mesal attachments on lateral lobes of the clypeus (C, *mdpr*), and it is further burdened with the necessity of explaining how the lower ends of the lora acquired a continuity with the hypopharynx before they separated from the clypeus.

The simplest and most satisfactory explanation that can be given of the nature of the hemipterous lora is the assumption that the loral plates are morphologically, as well as anatomically, lateral expansions of the parts of the hypopharynx on which the hypopharyngeal muscles of the mandibles take their origin (J, *mdh*). Heymons (1899), in his study of the embryonic development of the Hemiptera, says (p. 440) that the lora (laminae mandibulares) are derived from "Bestandtheilen des Mandibularsegmentes," though in describing the cicada (p. 422) he ascribes them to both the mandibular and the antennal segment, and in Heteroptera (p. 370) to the antennal segment alone. The attachment of mandibular muscles on the loral plates, however, is presumptive evidence that the lora themselves are derived from the mandibular somite, and there is no

question that the anterior part of the hypopharynx is formed from the venter of this somite.

The mandibular muscles attached on the sides of the base of the hypopharynx in orthopteroid insects are undoubtedly remnants of the primary ventral adductors of the mandibular appendages, though in modern biting insects it is questionable whether their contraction adducts the jaws or flattens the base of the hypopharynx. In orthopteroid and other insects with biting mouth parts in which these muscles occur (J, *mdh*), the muscles are attached mesally either directly on the base of the hypopharynx or on mandibular arms (*x*) of the suspensorial sclerites (*sus*) of the hypopharynx, and laterally on the inner surfaces of the lateral walls of the mandibles. The protractor arms of the hemipterous mandibles, on which the loral muscles are attached (E, K, *pa*), are not true apodemes but are proximal extensions of the lateral walls of the mandibular bases, and hence represent the same areas of the mandibles as those of biting insects (J) on which the hypopharyngeal muscles are attached. In the Hemiptera both of the primary articulations of the mandible on the subgenal margin of the cranium have been suppressed in order to give freedom of movement to the mandibular base; the articulation with the lorum (E, K, *k*) represents the mesal point of contact between the mandibular base and the base of the hypopharynx. The retractor muscle of the hemipterous mandible arising on the vertex (K, *1mdr*) is evidently the adductor muscle of the biting jaw; in the cicada the primitive cranial abductor appears to be represented by a second retractor muscle (K, *2mdr*) arising on the gena and inserted laterally on the mandibular base. The reduction in size of the mandibular bases in hemiptera has exposed the lateral parts of the hypopharynx on the sides of the head, and the retraction of the mandibles has converted the primitively adductor hypopharyngeal muscles of the mandibles into protractor muscles. The connection of the hypopharyngeal loral plates with the postclypeus, therefore, is a secondary union, which in some forms has progressed to a complete fusion by an obliteration of the clypeoloral sutures.

A morphological interpretation can not be fully acceptable unless it is consistent in all its implications. If the loral plates of the hemipterous head are lateral expansions of the base of the hypopharynx, we should find an entire conformity in the structure of the hypopharynx in Hemiptera with the structure of the hypopharynx in more generalized insects.

The removal of the anteclypeus and labrum of an homopterous insect, including the epipharyngeal wall of the anteclypeus, not only exposes the continuity of the lower ends of the loral plates with the median body of the hypopharynx (E, F), but reveals

also, on the base of the hypopharynx, a median, oval or elongate, basinlike cavity (*f*) with strongly sclerotic walls and well-defined marginal ridges. This cavity is the floor of the sucking pump (I, *f*). On the epipharyngeal surface of the removed anteclypeus (H) is the piston, or plunger, of the pump (*i*), which projects as an oval or elongate elastic fold from an epipharyngeal cavity with marginal ridges that normally fit tightly upon the marginal ridges of the hypopharyngeal pump floor. The relations of the epipharyngeal and hypopharyngeal parts of the pump are readily seen in a cicada if the "mouth" is forcibly opened by depressing the hypopharynx (I). The "orthopteroid" structure of the parts exposed at once becomes evident. The free terminal hypopharyngeal lobe (*d*) is only the apical part of the hypopharynx (*Hphy*), since the anterior surface of the latter continues upward to the mouth (*Mth*), includes the basinlike floor of the sucking pump (*f*), and gives off laterally the large loral plates (*Lor*). In addition, moreover, the hemipterous hypopharynx includes a pair of posterior plates (G, *h*, *h*) that arise from the base of the apical lobe and extend dorsally in the mesal and posterior walls of the invaginations that form the bristle pouches. The upper ends of these plates in Homoptera are generally united with the posterior arms of the tentorium (*PT*), and their haemocoelic surfaces give attachment to the dilator muscles of the salivary syringe. The hemipterous hypopharynx is thus seen to be a highly developed and complex structure forming many important elements of the feeding apparatus.

In order to understand the modifications that have produced the complex structure of the hypopharynx in Hemiptera, some attention should be given to the generalized structure of the organ shown in Orthoptera. In the hypognathous position, which may be taken as basic for descriptive orientation, the typical orthopterous hypopharynx hangs between the mandibles from the ventral wall of the head (J, *Hphy*). Its long anterior surface continues upward to the mouth (*Mth*); its relatively short posterior surface is reflected into the anterior wall of the labium at the base of the prementum, where is situated the orifice of the salivary duct.

The upper part of the anterior surface of the orthopteroid hypopharynx is always, and usually very distinctly, differentiated from the ventral part of the organ that forms the free tongue-like hypopharyngeal lobe (J, *d*), which may be termed specifically the *lingua*. The adoral supralingual area is generally depressed, and is flanked by a pair of sclerites (*sus*) from which two slender arms (*y*) extend upward into the angles of the mouth, where they enter the stomodaeal wall and give insertion to a pair of retractor muscles (*hf*) arising on the frons. This upper adoral hypopharyngeal structure serves in biting and chewing insects

as a receptacle for the masticated food passed back from the mandibles, and also, by the contraction of the frontal muscles inserted on its suspensorial sclerites, as a conveyor of the food to the mouth. In orthopteroid insects it often resembles a basket, but since in other insects it takes on various forms, it may be termed the *sitophore*, or "food carrier." To the sides of the suspensorial sclerites, usually on a pair of lateral arms (J, *x*), are attached the hypopharyngeal muscles of the mandibles.

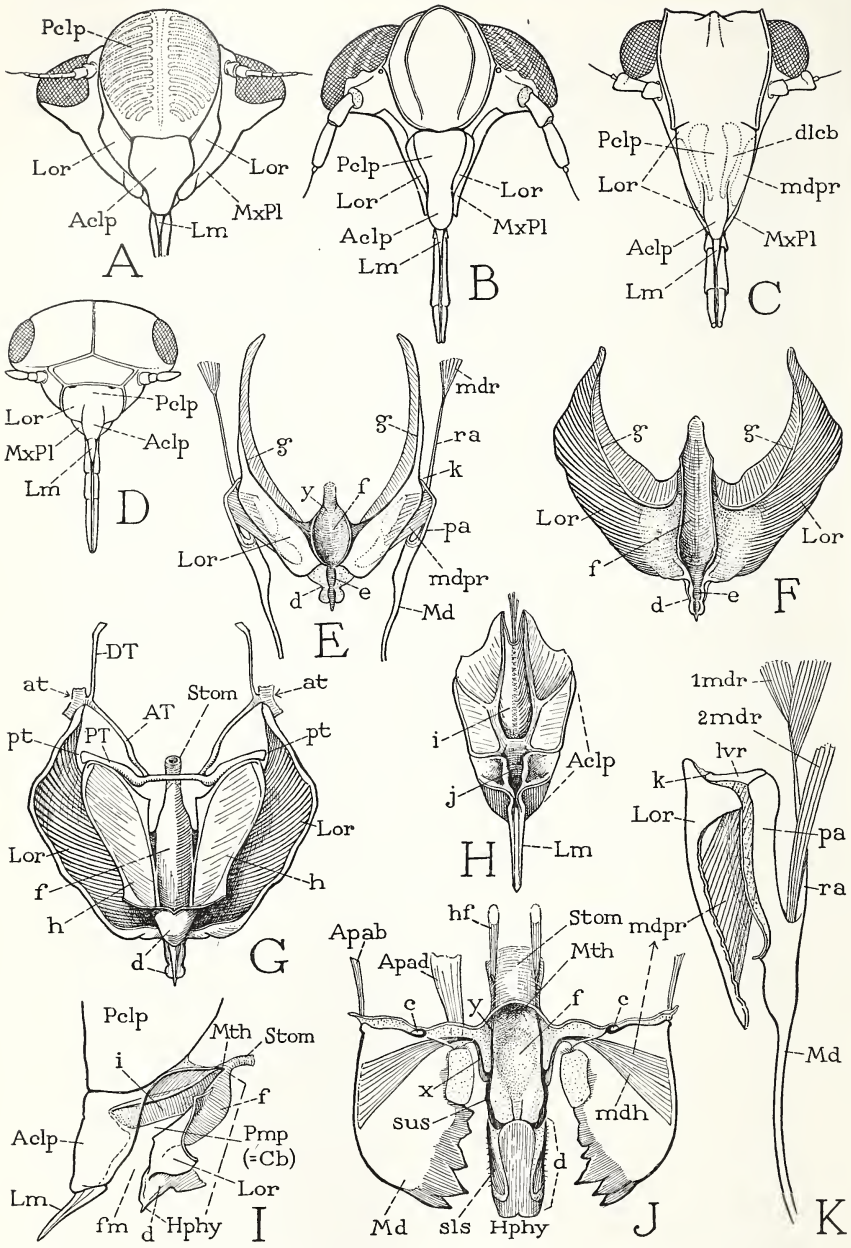
The sitophore of the hypopharynx, with the attached mandibular muscles, is characteristic of Orthoptera, is well developed in Dermaptera, and is typically present in Lepismatidae, but apparently it has no prototype in other apterygote insects or in other arthropods. Its suspensory sclerites have no clear relation to the premandibular suspensory plates (fulturae) of Chilopoda and Diplopoda that support the hypopharynx on the lateral margins of the cranium, and at most could be derived from only the mesal ends of these plates. In an earlier discussion of the insect hypopharynx the writer suggested that the food-carrying part of the organ may represent the venter of the tritocerebral somite, but the attachment of mandibular muscles on it would indicate that it belongs specifically to the somite of the mandibles.

The floor of the sitophore is the floor of the cibarial chamber of the preoral mouth cavity, which normally is covered by the inner, or epipharyngeal, wall of the clypeus. In the more generalized insects, as above noted, the sitophore is characteristically a basketlike structure suspended from the frons by the frontal muscles attached on its lateral arms. However, in coleopterous larvae it forms the large retractile preoral sclerite situated on the base of the hypopharynx, in Corrodentia and Mallophaga it becomes the curious mortarlike hypopharyngeal sclerite with thick basal arms on which the frontal muscles are inserted, and in Thysanoptera, Hemiptera, and Diptera it is the sclerotic basin of the sucking pump. The epipharyngeal dilator muscles of the cibarium arising on the clypeus probably play only a minor part in the process of ingestion with Orthoptera, but they become highly important elements of the "mortar-and-pestle" apparatus of Corrodentia, and of the pumping mechanism of sucking insects.

The free lobe, or true lingua (J, *d*), of the generalized hypopharynx has a pair of lateroventral sclerites (*sls*), which may be designated the *sublingual sclerites*. Though variable in size and shape, these sclerites, when typically developed, converge proximally in the posterior wall of the lingua and unite behind the orifice of the salivary duct. Contrary to usual statements, therefore, the salivary opening is on the base of the hypopharynx, and not literally between the hypopharynx and the labium. The sublingual sclerites give attachment, laterad of the

salivary orifice, to a pair of muscles from the tentorium. These muscles are antagonistic to the frontal muscles inserted on the suspensorial sclerites in that they swing the hypopharynx posteriorly, but it is probable that they are also retractors of the hypopharynx. Finally, it should be noted that one or two pairs of muscles traverse the base of the hypopharynx anteroposteriorly; they arise on the mandibular arms of the suspensorial sclerites and converge to the posterior wall of the lingua, where they are inserted just before or immediately upon the anterior lip of the salivary orifice, and serve to dilate the latter. These hypopharyngeal salivary muscles are usually opposed by one or two pairs of labial salivary muscles inserted on or near the posterior lip of the salivary opening.

A comparison of the hypopharynx and accessory structures in the Homoptera (E, F, I) with those in a cockroach (J) leaves little doubt of the homologies of the parts. The small free apical lobe (*d*) of the homopterous hypopharynx corresponds with the tongue-like appendicular lingua (*d*) of the blattid organ. The sucking pump of the hemipteron (I, *Pmp*) is the cibarium of the preoral mouth cavity, converted into a closed chamber by the close apposition of the hypopharyngeal wall against the epipharyngeal wall. The sclerotic, basinlike floor of the pump (E, F, I, *f*) represents the floor of the sitophore on the base of the orthopterous hypopharynx (J, *f*); the sucking action of the pump is produced by an elastic epipharyngeal lobe (H, I, *i*) operated by the greatly enlarged clypeal muscles. The lateral parts of the hypopharyngeal base, on which in the Orthoptera the mandibular muscles are attached (J), have been expanded in the Hemiptera to form the loral plates (E, F, I, *Lor*), on which the muscles retain their attachments, though by their altered positions they have become mandibular protractors. It is not necessary to suppose that the lora represent specifically only the mandibular arms of the orthopterous hypopharynx (J, *x*); it seems more probable that they are the expanded lateral parts of the basal region of the hypopharynx, which would be exposed on the sides of the head if the mandibles were reduced in size or removed. The posterior plates of the hemipterous hypopharynx forming the walls of the bristle pouches are evidently special developments in the Hemiptera, since they are correlated with the invagination of the mandibular and maxillary bases and with the presence of a salivary ejection apparatus, features not present in Orthoptera. The salivary outlet in the Hemiptera has been carried out to the apex of the hypopharynx apparently by an extension of the union of the sublingual sclerites behind it, which in the Orthoptera embrace only the mouth of the duct on the base of the hypopharynx. The musculature of the hemipterous hypopharynx has been simpli-


Pclp
Lor
Lor
Aclp
MxPl
Lm
A
Pclp
Lor
Lor
Aclp
MxPl
Lm
B
Pclp
dlcb
Lor
mdpr
Aclp
MxPl
Lm
C
Lor
Pclp
MxPl
Aclp
Lm
D
mdr
g
g
ra
y
f
k
pa
Lor
mdpr
d
e
Md
E
g
g
Lor
Lor
f
d
e
F
DT
at
Stom
at
AT
pt
PT
pt
Lor
Lor
f
h
h
d
G
i
Aclp
j
Lm
H
1mdr
2mdr
lvr
k
Lor
pa
ra
Md
K
hf
Stom
mdpr
Apab
Apad
Mth
c
y
f
c
x
sus
mdh
d
Md
sls
Hphy
J
Pclp
Mth
Stom
i
f
Aclp
Pmp
(=Cb)
Lor
Lm
fm
d
Hphy
I

fied because the organ is an immovable part of the feeding apparatus. The frontal and tentorial muscles appear to be absent, though the former may be represented by the first pair of stomodaeal dilators, which arise on the frons. The mandibular and salivary muscles, on the other hand, are highly developed, the first attached on the lateral loral plates, the second arising on the plates of the bristle pouches.

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Explanation of Plate.

A, *Cephisus siccifolius* Walk. (Cercopidae), head of nymph, showing usual relation of facial sclerites in auchenorrhynchous Homoptera.

B, *Pentagramma vittatifrons* (Uhl.), adult head, illustrating relatively small size of postclypeus in Fulgoridae, and lack of separation between postclypeus and anteclypeus.

C, *Ormenis pruinosa* (Say), example of a fulgorid having the lora (*Lor*) united with the postclypeus, as shown by origins of protractor muscles of mandibles (*mdpr*).

D, *Hemiodoecus fidelis* Evans (Peloridiidae), lora united with postclypeus as in the fulgorid *Ormenis* (C).

E, *Cephisus siccifolius*, nymph, hypopharynx and bases of mandibles, anterior view, exposed by removal of clypeus, showing continuity of the loral plates (*Lor*) with base of hypopharynx.

F, *Magicicada septendecim* (L.), hypopharynx and its loral expansions exposed by removal of clypeus.

G, same, hypopharynx and tentorium, posterior aspect.

H, same, posterior (epipharyngeal) surface of anteclypeus and labrum.

I, same, lateral view of preoral mouth cavity opened by depression of hypopharynx, showing chamber of sucking pump (*Pmp*) to be the cibarial cavity of orthopterous insects between base of hypopharynx and epipharyngeal wall of anteclypeus.

J, *Periplaneta americana*, mandibles and hypopharynx, anterior surface, showing tentorial mandibular muscles (*mdh*) attached on base of hypopharynx.

K, *Magicicada septendecim*, right mandible and muscles, showing homology of protractor muscle (*mdpr*) with hypopharyngeal muscle of mandible of *Periplaneta* (J, *mdh*).

Acip, anteclypeus (clypeolus); *Apab*, abductor apodeme of mandible; *Apad*, adductor apodeme of mandible; *AT*, anterior tentorial arm; *at*, anterior tentorial pit; *c*, anterior articulation of mandible; *d*, free lobe (lingua) of hypopharynx; *dlcb*, attachment of dilator muscles of sucking pump on postclypeus; *DT*, dorsal tentorial arm; *e*, median groove of hypopharynx; *f*, floor of sucking pump, or of food receptacle (sitophore), on base of hypopharynx; *fm*, food meatus; *g*, line of attachment of lorum with postclypeus; *h*, posterior plates of hypopharynx in walls of bristle pouches; *hf*, musculus hypopharyngis frontalis; *Hphy*, hypopharynx; *i*, epipharyngeal plunger of sucking pump; *j*, epipharyngeal depression receiving terminal lobe (*d*) of hypopharynx; *k*, articulation of protractor arm of mandible with lorum; *Lor*, lorum; *Lm*, labrum; *lvr*, lever of protractor arm of mandible; *Md*, mandible; *mdh*, musculus mandibuli hypopharyngealis; *mdpr*, musculus mandibuli protractor; *mdr*, musculi mandibuli retractores (*1mdr* arising on vertex, *2mdr* arising on gena); *Mth*, mouth; *MxPl*, maxillary plate; *pa*, protractor arm of mandible; *Pclp*, postclypeus; *Pmp*, chamber of sucking pump (preoral cibarial cavity, *Cb*); *PT*, posterior tentorial arm; *pt*, posterior tentorial pit; *ra*, retractor arm of mandible; *sls*, sublingual sclerite; *Stom*, stomodaeum; *sus*, suspensorial sclerite of hypopharynx; *x*, mandibular arm of suspensorial sclerite; *y*, oral arm of suspensorial sclerite.

SOME PSAMMOCHARIDAE FROM SINGAPORE.

By Nathan Banks.

During a visit of some months to Singapore, the late C. F. Baker collected a number of Psammocharidae there and on the island of Penang. These were sent to me by the National Museum in shipping the Baker Philippine Psammocharidae for my study. I have therefore made a report on these Singapore species. The collection is particularly interesting because of the number of Pseudagenini. Frederick Smith described a few species from Singapore, and Cameron and one or two others have added a few; but much of the fauna is still unknown. Many of the species are the same as occur in the lowland areas of Borneo, Celebes, and the Philippines, and doubtless other parts of the Insulinde. Of a number of old species I have added some descriptive matter, omitted from the originals. The classification is explained in my paper on the Philippine forms.

The holotypes and uniques of the material herein discussed are in the U. S. National Museum and some paratypes are in the Museum of Comparative Zoology at Cambridge, Mass.

CRYPTOCHEILINAE.

Hemipepsis fulvipennis Fab.

Fairly common at Singapore, and generally over the Malay region.

Hemipepsis ceylonicus Sauss.

One from Singapore.

Cyphononyx fugidipennis Sm.

From the Island of Penang.

Cyphononyx cameroni, sp. nov.

Face almost wholly black, a pale orbital line each side opposite antennae; antennae, body, and legs black, tarsi brown, mid and hind tarsi partly yellowish, the extreme base of the front tibiae yellowish; wings black, violaceous, the front wings have a large yellowish area in middle, somewhat interrupted at base of the second discoidal cell, hind wings with a pale spot over the base of cubital fork. Clypeus nearly truncate, with only short hair, above antennae the hair is longer, a line from anterior ocellus to antennae; ocelli subequal, the posteriors are much nearer to each other than to the eyes; antennae not at all crenulate, the third joint plainly longer than the fourth, but not equal to vertex width; pronotum hairy, arcuate behind; propodeum evenly arched, strongly, transversely carinate, with dense long hair; scutellum and postscutellum high and crested; abdomen rather small, hairy on base, toward tip, and somewhat on venter. Legs slender; femora with some fine hairs; hind tibia with two rows of very short spines above, and about as long ones below; long spur of the hind tibia about two-fifths of the basitarsus. Wings rather large; stigma very short, marginal cell long and slender, pointed at tip, third submarginal hardly twice as long below as broad, much narrowed above, longer than the second submarginal; first recurrent ends almost at tip of the second submarginal cell; second recurrent, bent outward, ends near basal third of third submarginal cell. Length 17 mm. Forewing, 18 mm.

From Singapore. It does not agree with any in Bingham's India, but is undoubtedly related to *Salius venatorius.*

Monodontonyx plutonis, sp. nov.

Black; front legs and mid and hind tarsi more reddish brown; wings of a brownish yellow color, a little darker on base, but without a dark band at tip. Head, pronotum, scutelli, propodeum, pleura with long black hair, coxae also with rather long hair, long hair on venter and near tip of abdomen, first segment above only hairy near base. Clypeus truncate below; ocelli subequal, posteriors about twice as near each other as to eyes; antennae slender and long, third joint much longer than fourth, second plus third plainly longer than vertex width; pronotum deeply arcuate behind; scutelli rounded, not high; propodeum transversely carinate, nearly smooth near tip; abdomen rather narrow at base, not

very convex, last segment above with ferrugineous appressed hair. Legs long and slender, tibiae and tarsi quite heavily spined, hind tibia above with an inner row of large teeth with spines, and an outer row of fewer spines, long spur of hind tibia fully one-third of basitarsus. Wings moderately slender, stigma very small, marginal cell long and pointed; third submarginal more then twice as long as broad, narrowed one-third above, much longer than the second submarginal, and this more than twice as long as broad; first recurrent ends near tip of the second submarginal, second recurrent nearly evenly bowed outward, ending at basal third of third submarginal cell; in hind wings anal ends at cubital fork. Length 18 mm. Forewing, 18 mm.

From Singapore, Malacca.

Monodontonyx sericosoma Sm.

From Singapore, as also in other parts of the Malay region and in India.

Monodontonyx javanus Lep.

Several from Singapore, also in Java, India, and the Philippines.

MACROMERINAE.

1. Femora with fine hair below; base of second submarginal cell very oblique, reaching considerably forward ..... *Macromerini*
   Femora without the fine hair; base of second submarginal not nearly as oblique 2
2. Hind tibia with a row of distinct teeth above ..... *Priocnemini*
   No such teeth on hind tibia, only very small spines if any 3
3. Pronotum elongate and flattened; head flattened and antennae set low as in Platyderes; front femora enlarged ..... *Apinaspini*
   Pronotum short; head not flattened and antennae set higher ..... *Pseudagenini*

MACROMERINI.

Macromeris violacea Lep.

A few from the Island of Penang; common in all the Malay region and Insulinde.

Paragenia argentifrons Sm.

Several from Singapore. Clypeus very convex and hairy, faintly rounded, but almost truncate below, in middle of margin with a minute sharp point; face a little narrowed above; anterior ocellus a little the larger, hardly its diameter from the posteriors, latter closer to each other than to the eyes; third joint of antennae much longer than the fourth, and of itself longer than the vertex width; pronotum angulate behind; propodeum closely transversely striate, extending down on the sides to the suture; sides of the metanotum also striate; mid and hind

tibiae with short spines all around; femora with fine short white hairs below; long spur of hind tibia only about one-third of basitarsus. In forewings the second submarginal cell is over four times as long as broad, the base extremely oblique, receiving the first recurrent beyond the middle third; third submarginal a little longer below than the second, narrowed about one-third above, receiving the second recurrent beyond the basal third; in hind wings the anal vein ends before the cubital fork.

PSEUDAGENINI.

Synopsis of the genera:

1. Joints of maxillary palpi not elongate, and somewhat enlarged at tips; basal segment of abdomen fully equal to the second (second not enlarged) ..... *Dinagenia*
   Joints of maxillary palpi elongate, not enlarged at tips 2
2. Clypeus with a distinct median process on lower edge; base of clypeus very oblique each side ..... *Conagenia*
   No such process, at most clypeus with a point in middle below 3
3. Pronotum above nearly or quite as long as the mesonotum, both granulate as is also rest of thorax ..... *Meragenia*
   Pronotum shorter than mesonotum 4
4. Mesonotum behind longitudinally striate; marginal cell triangular ..... *Lophagenia*
   Mesonotum not striate 5
5. Median vein reaches the wing margin ..... *Minagenia*
   Median vein at least a little short of the margin 6
6. Last tarsal joint with a few spines below ..... *Phanagenia*
   Last tarsal joint smooth beneath ..... *Pseudagenia*

Minagenia, sp.

A number of male specimens from Singapore appear to belong here; the clypeus and under side of the basal joint of the antennae yellowish; the legs (except tips of hind pairs) largely yellowish; the third segment of abdomen has a basal yellowish band which on the sides reaches forward. There is no female in the collection to which it can belong, and I know of no species of this genus from India.

Dinagenia satyrus, sp. nov.

Black; face, pronotum, mesonotum, and scutellum with golden pubescence, fainter near tip of abdomen; last segment of abdomen yellowish; propodeum with golden sheen in certain lights; legs (except coxae) yellowish; antennae yellowish, last six joints black; wings yellowish, tips of forewings only very faintly darker, veins and stigma yellowish. Clypeus truncate below; labrum entire; face but little narrowed above; anterior ocellus a little larger than the posteriors and not its diameter from them, latter two diameters apart and a little further from the eyes; antennae rather short and hairy; third joint not quite as long as fourth, second plus third about equal to vertex width; pronotum rather long, hind

border arcuate; propodeum moderately arched, strongly transversely wrinkled, and with a median line, with some erect hair on sides. Abdomen rather long, fusiform, petiole moderately short, apex and venter hairy; legs rather short and stout, mid and hind tibiae with few very short spines; long spur of hind tibia fully one-half of basitarsus. Forewings with marginal cell about two-thirds its length from wing-tip; second submarginal not quite twice as long as broad, base curved, receiving the first recurrent vein at middle; third submarginal scarcely longer than second below, fully one-third narrowed above, receiving the second recurrent (slightly curved) a little beyond the basal third; third abcissa of radius much shorter than the second, latter subequal to the fourth; in hind wings the anal is interstitial with cubital fork. Length 12.5 to 15 mm.

From Singapore. Differs from *D. apollo* in lack of yellow on thoracic notum, in having more joints of antennae black, etc. What may be the male is more slender, body black, very hairy all over, but without golden pubescence; the legs (except coxae) yellowish, but hind femora and tips of tibiae dark; antennae black, except the pale yellowish basal joints; wings yellowish, but not as clear as female, the venation the same. Length 12 mm. From Singapore.

PHANAGENIA.

1. Hind femora black; forewings with dark stigmal band ..... *banoensis*
2. Forewings plainly banded with dark ..... *bipennis*
3. With silvery pile; propodeum plainly striate wholly across ..... *tincta*
   With dull pale golden pile; propodeum scarcely striate, and these not complete to down on the sides ..... *hippolyte*

Phanagenia banoensis Rohwer.

One from Singapore, and like the Philippine specimens.

Phanagenia tincta Sm.

Many from Singapore, and one from the Island of Penang. The face is plainly narrowed above; a line from antennae to anterior ocellus; ocelli in a nearly equilateral triangle, the anterior ocellus rather larger, the posteriors nearer to each other than to the eyes; the third joint of antennae much longer than the fourth and equal to vertex width; propodeum with distinct striae reaching down on the sides to the suture. In the forewings the second submarginal cell is about twice as long as broad, the base curved, receiving the first recurrent beyond the middle; the third submarginal cell longer than the second, narrowed about one-third above, and receiving the second recurrent vein (bent below middle) at basal third; long spine of the hind tibia not one-half of the basitarsus.

Phanagenia hippolyte Sm.

Three from Singapore and Island of Penang. The dull, pale golden pile on face and propodeum behind is also on the lower mesopleura, on sides of the mesonotum, and on the pronotum, usually with two spots on upper surface behind as well as on sides and front. The face is a little narrowed above, there is no distinct line from antennae to the anterior ocellus; the ocelli rather large, the posteriors scarcely more than diameter apart and a little farther from the eyes, third joint of antennae much longer than the fourth and longer than vertex width; the propodeum is scarcely striate, and no sign of striae down on sides toward the suture. In the forewing the second submarginal cell is twice as long as broad, base oblique, receiving the first recurrent near middle; the third submarginal cell is much longer than the second, narrowed one-third above, and receiving the second recurrent (bent at middle) at basal third; the long spur of hind tibia is one-half of the basitarsus.

Phanagenia bipennis Sauss.

Many of both sexes from Singapore, and a few from Island of Penang; the female of this agrees fairly well with *hypsipyle*. Clypeus rounded below, almost in a point; face but little narrowed above; faint line from antennae to anterior ocellus; posterior ocelli almost twice as near to each other as to eyes; third joint of antennae longer than fourth, second plus third hardly equal to vertex width; pronotum almost angulate behind; propodeum densely, finely striate, complete to the suture, hairy above; long spur of hind tibia not one-half of basitarsus; mid and hind tibiae with very distinct spines in rows (longer than in many species). In forewing the second submarginal cell fully twice as long as broad, narrowed nearly one-third above, receiving the first recurrent near middle; third submarginal longer and much wider behind than the second; narrowed scarcely one-third above, receiving the second recurrent before end of basal third; transverse nervure well beyond the basal vein; in hind wing the anal ends a trifle before the cubital fork. Male has the venation as in female, basal abdominal segment very slender; clypeus truncate below, long spur of hind tibia nearly two-thirds of basitarsus; the white each side on inner orbit runs across ends of clypeus, and on tips of mandibles; under side of basal joint of antennae pale.

PSEUDAGENIA.

1. Clypeus pale 2
   Clypeus black 3
2. Pronotum largely pale, also tegulae and base of antennae ..... *flavopicta*
   Pronotum and antennae wholly black ..... *bimaculata*
3. Hind femora reddish (sometimes others also) wings rarely banded 4
   Hind femora black or brown 9
4. Body very distinctly more or less metallic blue; propodeum transversely striate ..... *blanda*
   Body not distinctly bluish 5
5. Mandible wholly black 6
   Mandibles largely white 7

6. Smaller; clypeus in small point below; face broader; wings scarcely infuscate; anal in hind wings plainly before cubital fork. ..... *malayana*
   Larger; clypeus rounded below, hardly a point; face more narrow; forewings more or less infumate; in hind wings the anal is interstitial with the cubital fork ..... *moesta*
7. Front femora, at least, dark; clypeus somewhat pointed below ..... *tagalensis*
   Front legs yellowish or yellow-brown, as also middle and hind pairs 8
8. Clypeus truncate or a little emarginate in middle below ..... *honesta*
   Clypeus rounded or almost pointed in the middle below ..... *agitata*
9. Clypeus distinctly emarginate in middle below; forewings with cloud near stigma ..... *nitidiventris*
   Clypeus not emarginate, but almost pointed in middle below 10
10. Body plainly somewhat bluish; forewings without distinct cloud; propodeum rugoso-striate ..... *calosoma*
    Body not bluish; forewings with dark bands or clouds 11
11. Band over basal vein and broader one back of the stigma; propodeum nearly flat ..... *morota*
    Narrow band only back of the stigma; propodeum high and sloping ..... *celaeno*

Pseudagenia blanda Guerin.

Many from Singapore; the male appears to agree with *P. albolabris* Bingh.

Pseudagenia bimaculata Sm.

A few from Singapore.

Pseudagenia tagalensis, Bks.

A few from Singapore, like the Philippine form.

Pseudagenia morota, Bks.

All from Singapore, and does not seem to differ from the Philippine type.

Pseudagenia nitidiventris Sm.

From Singapore, also from the Philippines and Celebes.

Pseudagenia calosoma, sp. nov.

Body blue to blue-black, legs and antennae brown to black, wings clear, unmarked, stigma brown. Some whitish pubescence on lower face and clypeus and on lower mesopleura and tip of propodeum and coxae, but not at all prominent. A few short hairs on front and pronotum, longer ones on the propodeum and pleura, tip, and venter of abdomen. Clypeus wedge-shaped, coming to a rounded point in middle below; face a little narrowed above; a line from antennae goes only a short distance; ocelli moderately large, anterior scarcely more than

diameter from posteriors, these hardly two diameters apart, but farther from the eyes; third joint of antennae much longer than the fourth, second plus third fully equal to vertex width; pronotum only slightly and somewhat angularly emarginate behind; propodeum rather densely transversely rugoso-carinate, median line distinct on base; abdomen with a short pedicel, pygidium polished, elongate, scarcely broader behind; mid and hind tibiae with scarcely a trace of spines, long spur of hind tibia about one-half of basitarsus. In forewings marginal cell fully one-half its length from wing-tip; second submarginal cell twice as long as broad, base slightly oblique, receiving the first recurrent just before middle; third submarginal cell much longer and wider behind than the second, narrowed one-fourth above, receiving the second recurrent (much curved) near basal fifth; in hind wings the anal ends plainly before the cubital fork; in forewings the transverse only a trifle beyond the basal vein. Length 7 mm. From Singapore and Island of Penang.

Pseudagenia moesta, sp. nov.

Black, hind femora reddish, forewings slightly infumate; lower face and clypeus with silvery pubescence, also on much of pronotum, pleura, coxae, and sides of the propodeum, less distinctly on sides of the abdomen; palpi dark. Rather short erect white hair on front, vertex and pronotum, much longer on the propodeum and pleura, short on basal segment of abdomen above, and longer on tip and venter.

Clypeus short, rather broadly rounded below, hardly pointed below; face broad, but plainly narrowed above; a faint line from antennae to anterior ocellus, ocelli in a low triangle, subequal, posteriors a little nearer to each other than to eyes; third joint of antennae but little longer than the fourth, second plus third scarcely equal to vertex width; pronotum only slightly but almost angularly emarginate behind; propodeum evenly rounded, with a very distinct median furrow, heavily punctured, in some lights traces of transverse striae; mesopleura also much punctured; abdomen with a distinct pedicel; mid tibiae with many small but distinct spines above, hind tibiae have no noticeable spines; long spur of hind tibia fully one-half of basitarsus. Forewings with marginal cell more than one-half its length from wing-tip; the second submarginal cell about twice as long as broad, base curved, receiving the first recurrent at middle; third submarginal much longer and broader behind than second, narrowed about one-third above, receiving the second recurrent (scarcely curved) a little before the middle; third abcissa of radius longer than the second, which is longer than fourth; in hind wings the anal vein is interstitial with the cubital fork; in forewings the transverse nervure is plainly beyond the basal. Length 9 to 11 mm. Forewings 8 to 10 mm. From Singapore.

Pseudagenia honesta Sm.

From Singapore and Island of Penang. The body black with some silvery pubescence; palpi and mandibles white; lower margin of clypeus yellowish; antennae brown, first joint ferrugineous beneath; hind margin of pronotum and the tips of abdominal segments alutaceous; legs (including coxae) yellowish; wings hyaline, stigma dark; body not especially hairy.

Clypeus truncate in middle below, with somewhat of a hump each side, so

the middle is almost emarginate; ocelli subequal, posteriors much closer to each other than to the eyes; third joint of antennae long and slender, much longer than the fourth, of itself about equal to vertex width; pronotum short, faintly angulate behind; propodeum sloping, hairy, above, with a median furrow, not striate, but punctate behind; abdomen rather slender with a short pedicel, apex with some long and many short hairs, basal segment short-haired above, venter with rather short hairs; mid and hind tibiae with many distinct, but short spines, some above in rows; long spur of hind tibia more than one-half of basitarsus. Forewings with marginal cell broad, hardly one-half of length from wing-tip, second submarginal cell nearly twice as long as broad, base curved, receiving the first recurrent vein near the middle; third submarginal cell no longer than the second, and somewhat narrowed above, receiving the second recurrent (bent in middle) near basal fourth; third abcissa of radius about equal to second, which is subequal to fourth; in hind-wings the anal ends much before the cubital fork. Length 8 mm. Forewing 8 mm.

In the specimen from Island of Penang there is a dark stigmal cloud in the forewing. I am inclined to identify this with the *Agenia honesta* Smith from Macassar; however, it is not particularly hairy. There is no need of a change of name as the *Pompilus honestus* Sm., which Bingham puts in Pseudagenia, is now considered to be a *Macromeris*.

Pseudagenia flavopicta Sm.

One from Singapore. Clypeus broad, rounded below; face narrowed above, widest at middle; line from antennae to anterior ocellus; ocelli rather large, posteriors about as near eyes as to each other; antennae slender, third joint longer than fourth, second plus third equal vertex width; pronotum broadly but not deeply concave behind, with a median impression; propodeum sloping, not striate, hairy above, with a median furrow; mid and hind tibiae practically without spines; long spur of hind tibia more than one-half of basitarsus. In forewings the first recurrent vein beyond middle; third submarginal cell much longer below than the second, narrowed more than one-third above, receiving the second recurrent near basal third; transverse nervure much beyond the basal vein; in hind wings the anal ends much before the cubital fork.

Pseudagenia, sp.

Many males from Singapore are almost wholly yellow, with black on vertex and mesonotum, and on some segments of abdomen, brownish antennae and hind legs. They might be males of *Pseudagenia flavopicta*, but probably another species.

Pseudagenia celaeno Sm.

One from Singapore. Clypeus rounded below, point but little developed; face plainly narrowed above; a line from antennae to anterior ocellus; ocelli rather large, posteriors much nearer to each other than to eyes; third joint of antennae longer than fourth, second plus third not quite equal to vertex width; pronotum but little concave behind; propodeum very finely striate, with a median line; long spur of hind tibia fully one-half of basitarsus; hind tibia with

only very minute spines in rows. In forewing the second submarginal not twice as long as broad, base curved, receiving the first recurrent vein near middle; third submarginal plainly longer than second, narrowed about one-fourth above, receiving the second recurrent vein before end of the basal fourth, in fact very near the base of the cell; transverse nervure about interstitial with basal.

Pseudagenia malayana Cam.

Several from Singapore. Clypeus strongly convex, rounded below; a line from antennae to anterior ocellus; posterior ocelli very much closer to each other than to the eyes; third joint of antennae but little longer than the fourth, second plus third not equal to vertex-width; pronotum but little concave behind; propodeum finely striate, and with a median line; long spur of the hind tibia more than one-half of basitarsus; in forewing the second submarginal cell is about twice as long as broad, narrowed about one-third above, receiving the first recurrent vein near the middle; third submarginal cell a little longer than the second, also about one-third narrowed above, and receiving the second recurrent vein before end of the basal third; transverse nervure well beyond the basal vein.

Pseudagenia agitata Sm.

Several specimens from Singapore and Island of Penang, agree with Smith's description of color, and in comparison with *P. honesta;* the face and clypeus is more silvery than in *P. honesta*, the coxae are black, and the second submarginal is much shorter than the third, the second recurrent ends near basal third. The clypeus is wedge-shaped, pointed below in middle; the ocelli in a low triangle, the posteriors a little nearer to each other than to the eyes; the third joint of antennae a little longer than fourth, second plus third not equal to vertex width; the pronotum slightly arcuate behind; the propodeum with median furrow, very hairy above, without distinct striae, but much punctate, mostly behind; the mid and hind tibiae with very short and weak spines; the long spur of the hind tibia fully one-half of basitarsus. Some specimens show a little blue or greenish on mesonotum.

Lophagenia erigone Bingh.

One from Singapore. Also occurs in the Philippines.

CONAGENIA.

1. Thorax reddish ..... *aegina*
   Thorax black 2
2. Third submarginal cell nearly twice as long as broad; tips of wing white; larger species ..... *nasuta*
   Third submarginal not near so long; tips of wings clouded; smaller species ..... *williamsi*

Conagenia williamsi Rohwer.

Several from Singapore agree with those from Philippines.

Conagenia nasuta Sm.

Many from Singapore; larger than *C. smithi* of the Philippines, but very similar.

Conagenia aegina Sm.

Many from Singapore, and one from the Island of Penang; it is the species which Bingham identifies as *P. aegina*, but possibly wrongly.

MERAGENIA.

1. Thorax reddish ..... undescribed species
   Thorax black as head 2
2. Abdomen reddish, forewings almost wholly dark ..... *semirufa*
   Abdomen black; wings mostly clear or only a little infuscate 3
3. Pronotum and rest of thorax quite hairy, with a silvery sheen; ocelli large, posteriors hardly more than diameter apart; larger species ..... *stulta*
   Pronotum and rest of thorax scarcely at all hairy; ocelli smaller, posteriors one and a half to two diameters apart; smaller species ..... *imitator*

Meragenia imitator Ashm.

Numerous specimens from Singapore, agree with those from the Philippines.

Meragenia stulta Bingh.

Common at Singapore.

Clypeus broad, almost truncate below, the apical middle with a polished area; face widest at clypeus, much narrowed above; no line to anterior ocellus; ocelli rather large, anterior hardly its diameter from the posterior, latter nearer to each other than to the eyes; antennae short, third joint longer than fourth, second plus third hardly equal vertex width; pronotum behind only a little concave, and with a median impression; mid and hind tibiae with only minute spines; long spur of hind tibia one-half of basitarsus. In the forewings the second submarginal cell is more than twice as broad, base oblique, receiving the first recurrent near middle; third submarginal longer below than second, narrowed one-third above, and receiving the second recurrent near basal third; transverse nervure much beyond the basal vein; in hind wings the anal ends before the cubital fork. The male is similar in color, venation, and sculpture of thorax and propodeum; the pronotum is not square in front, but rounded; the body is very hairy, the slender abdomen has the first segment mostly pedicel; face not as much narrowed above as in female, antennae fully as long as in female, subcrenulate, third joint no longer than fourth; posterior ocelli twice as far from eyes as from each other; long spur of hind tibia almost two-thirds of basitarsus.

Meragenia semirufa, sp. nov.

Black, abdomen reddish, sometimes tip darker, wings of both pairs fumose, the first pair darker, and the dark extending to the base; antennae brown; legs brown, the mid and hind coxae and femora rufous; palpi brown. Body with white pubescence, most observable on lower face and clypeus, but usually patches on pronotum, much of pleura, propodeum, and coxae, and even on the sides of the abdomen. Short erect hairs on head and pronotum, longer (but

still rather short) on propodeum and pleura, tip and venter of abdomen; with some very short hair on most of the dorsal segments.

Clypeus distinctly a little concave below; labrum emarginate in middle; face narrowed above, line above antennae goes only a short distance; ocelli large, close together, anterior not near its diameter from posteriors, latter hardly one diameter apart, more than twice as far from the eyes; antennae very short and thick, fourth joint not three times as long as broad, third plainly a little longer, second plus third about equal vertex width; the pronotum very slightly and almost angularly emarginate behind, posterior margin with a median line; mesonotum with the median strip very finely punctate, much coarser on rest of mesonotum; the propodeum rounded, transversely rugoso-striate and granulate, no median line; abdomen elongate, slender, apical part somewhat compressed, short pedicel; mid and hind tibiae with scarcely visible spines; long spur of hind tibia one-half of basitarsus. Forewings with marginal cell long and slender, hardly one-half its width from wing-tip; second submarginal cell twice as long as broad, base curved, receiving the first recurrent at middle; third submarginal very much longer and larger behind than second, about one-fourth narrowed above, receiving the second recurrent (moderately curved) about two-fifths from base; third abcissa of radius very much longer than second, which in turn is much longer than fourth, latter only a little longer than first; in hind wings anal ends plainly before cubital fork; in forewings transverse is one-third to one-fourth beyond basal.

Length 11 mm., forewing 9 mm. From Singapore.

What I presume is the male, is much more slender with a very hairy body even on the abdomen, as well as on all the femora; the body is black, except that the base of abdomen is more or less rufous; basal antennae joint sometimes rather pale; mid and hind coxae and femora rufous; the forewing very dark as in the female, but the extreme base is usually hyaline for a short distance; the hind wing less dark. The venation is the same; the antennae about as long, but less curled than in female, the fourth joint about two and one-half times as long as broad, the third scarcely larger; the long spur of hind tibia is more than one-half the basitarsus, and the spines on mid and hind tibia rather more distinct than in female. Length 7 to 9 mm.

APINASPINI.

Apinaspis myrmecoides Bingh.

A number of females from Singapore; this species deserves a new genus which I call *Apinaspis*.

In the forewing the marginal cell is not near its length from tip of wing; there are three submarginal cells; there is no distinct pocket in the base of the second discoidal cell; the transverse nervure is beyond the basal vein. The head is much like *Platyderes*, flattened, the antennae set low, just above the clypeus about at lower edge of eyes, the clypeus very short, fully four times as broad as long, hardly one-half as long as the first joint of the antennae, the maxillary palpi slender, the joints elongate. Legs almost devoid of spines, only extremely minute ones on the mid and hind tibiae and tarsi; the last tarsal joint has on the under side, one or two small spines in middle, none laterally; the claws have a large tooth near tip, set at almost a right angle to tip of claw; spines at tips of

tibiae extremely minute, practically absent; no spines at tips of femora. The pronotum is elongate, each upper edge almost a ridge; the abdomen is somewhat compressed on the apical part, the second ventral segment without a groove.

In this species the basal joint of the front tarsi is longer than the next three together; the front femora plainly swollen.

PSAMMOCHARINAE.

Episyron leucophoeus Sm.

The male agrees with Smith's description of the color (two spots on the clypeus; the female has a pale line along the lower border of clypeus not reaching either end). In general it is similar to other species of the genus, the second submarginal is very much narrowed above so that its top is but little longer than the top of the third, the latter below is much shorter than the second. In the female the long spur of the hind tibia is about three-fourths of the basitarsus, in the male almost equal to basitarsus; the spines are black.

Several specimens from Singapore.

Episyron vagabundus Sm.

This differs not only in having most of the hind tibia reddish, but in that the spines on mid and hind legs are pale, or at least not black. The second submarginal cell is longer than usual, and about twice as long as the third, which is very short. In the male the lateral spots on clypeus are not connected below.

Several from Singapore.

Sericopompilus canifrons Sm.

A common species at Singapore, and one from the Island of Penang; common in India.

Sericopompilus perplexus Sm. ?

A few, probably this species, from Singapore.

Sericopompilus atropos Sm.

One female from Singapore.

Clypeus broad, faintly concave below; face narrowed about one-third above, ocelli in a low triangle, the posteriors much nearer to the eyes than to each other; third joint of the antennae much longer than fourth, and equal to vertex width; pronotum angulate behind; propodeum short, evenly rounded with a median line, no striae, and with only extremely short, fine hairs above; long spur of hind tibia equal one-half of basitarsus; front tarsus with rather short comb spines, three on basitarsus, their length apart. In forewing the marginal cell about three-fourths its length from wing tip; second submarginal a little longer than broad, base curved, receiving the first recurrent near tip; third submarginal about as long below as second, greatly narrowed above, so that the third abcissa

of radial sector is not one-third of the second; second recurrent vein received at apical third; basal vein and transverse nervure interstitial; in hind wing the anal ends about at the cubital fork.

Ferreola bakeri, sp. nov.

Black with silvery pile, except on tarsi; on the abdomen a broad apical band on first three segments, on fourth only a median spot, and still smaller on the next, first three ventral segments largely silvery.

Vertex rounded, although fairly thin; face much narrowed toward vertex, clypeus broadly rounded, but almost truncate below; antennae short, second and third joints together not longer than the first; ocelli large, posteriors hardly more than diameter from the anterior, and scarcely farther from each other than from the eyes; pronotum moderately long, rounded, angulate behind; propodeum nearly flat on basal part, behind deeply cut out, the sides forming blunt processes.

Abdomen with hairs at tip and on venter. Front legs almost without spines, numerous spines on mid and hind tibiae and tarsi, and on the apical part of these femora above; last joint of hind tarsus smooth below, long spur of the hind tibia only about one-half of the basitarsus, claws cleft.

Forewings with the basal interstitial with the transverse, marginal cell long, about its length from wing-tip; second submarginal cell longer than high, base curved, apex straight; third submarginal shorter than the second, very much narrowed above; first recurrent vein ends beyond the middle of second submarginal, second recurrent vein ends beyond middle of the third submarginal, this vein is sinuous. The male is very similar, but narrower throughout.

Length 12 mm., forewing 10 mm. Length 9 mm.

From Singapore, Malay peninsula.

Homonotus ariadne Cam.

One from Singapore, also from Hong Kong.

Xanthampulex pernix Bingh.

Three from Singapore; known also from India.

AN IMPORTANT MULBERRY INSECT.

By Carl Heinrich.

In a paper published in 1935,[1] Miss K. O. Victoria Lieu described the new species *Paradoxecia pieli* (Lepidoptera: Aegeriidae), discussed briefly its life history, and gave figures of the moth, larva, and pupa. In 1933 she began work on the biology of this insect at Kashing and continued it at Hanchow

[1] Lieu, K. O. Victoria. Study of a New Species of Chinese Mulberry-Borer. Musée Heude, Notes d'Entomologie Chinoise, vol. 2, fasc. 10, pp. 185–208, Dec. 20, 1935.

until June, 1934. Thence her activities were transferred to Shanghai, where she held a position as Honorary Research Fellow of the Musée Heude. The war interrupted her work in Shanghai and it is now being carried on in the mulberry-producing districts in Szechwang Province, where she is studying also the cerambycid borer *Pascothea hilaris* Pasco and other mulberry borers. She has been able to work out many details of the life history of *Paradoxecia pieli*. A recent letter (June 10, 1938) informs me that she completed her biological study of this species in 1937, but is still engaged in control studies.

A preliminary paper on the biology of *Paradoxecia pieli* was published by Miss Lieu in Chinese, with an English abstract, in December, 1935,[2] and a more extended paper is being prepared. Previously J. T. Chu and Shing-Mu-Chin had published an independent account of the insect in Chinese (without, however, definitely identifying or naming it) under the title "Notes on a Mulberry Twig Borer and its Control Experiments" (Entomology and Phytopathology, vol. 2, nos. 32–33, p. 627, 1934).

Apparently *Paradoxecia pieli* is a serious pest of the mulberry. It is interesting to the systematic lepidopterist chiefly because it represents a genus not found in the Western World and because it differs greatly from typical Aegeriidae in many of its adult, larval, and pupal characters.

The male genitalia have the uncus simple, and developed as a long, strong, curved hook. The harpes are nearly square in outline with their apices slightly rounded.

In the female genitalia the signa consist of a pair of narrow, curved plates with their concave edges opposed.

The pupa is easily recognized, for, in addition to the ordinary aegeriid characters, it has a strongly humped thorax and a cluster of strong lateral spines below each spiracle on abdominal segments 4 to 8 of the male and 4 to 7 of the female.

The larva (except for the arrangement of crochets on the prolegs) resembles more a cossid of the subfamily Zeuzerinae than an aegeriid. The thoracic shield is greatly enlarged and produced backward into a mid-dorsal, serrate peak. The apical three segments of the abdomen are sharply sloping and dorsally fused by a sclerotized plate sloping upward (and continuing the anal shield) to the anterior third of the eighth segment and including the dorsally placed spiracles of the eighth abdominal segment.

The holotype and some of the paratypes have been deposited in Musée Heude, Shanghai, and other paratypes, as well as larvae and pupae, in the U. S. National Museum.

[2] Lieu, K. O. Victoria. Preliminary notes on the Biology and Control of the Mulberry-Borer, *Paradoxecia pieli* Lieu (Lepidoptera, Aegeriidae). Report to the Hangchow Bureau of Entomology, Dec. 23, 1935.

MINUTES OF THE 494TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

The 494th meeting of the Society was held at 8 p. m., Thursday, October 6, 1938, in Room 43 of the National Museum. In the absence of President Back, Mr. R. E. Snodgrass presided. The attendance was the largest of the year, there being 52 members and 16 visitors present for a total of 68. The minutes of the June meeting were read and approved.

The following individuals were elected to membership in the Society:

Whiteford L. Baker, Division of Forest Insect Investigations, Lebanon, Tennessee.

C. M. Gjullin, Division of Insects Affecting Man and Animals, Portland, Oregon.

B. H. Wilford, Division of Forest Insect Investigations, 223 Federal Building, Asheville, North Carolina. All three of the Bureau of Entomology and Plant Quarantine.

C. F. W. Muesbeck gave a short resumé of his visit to the 7th International Congress of Entomology held at Berlin.

The regular program consisted of a symposium on Insect Identification and Classification. The five talks were as follows:

1. Organization of Division of Insect Identification and Scope of Work.—C. F. W. Muesebeck.

The Division of Insect Identification of the Bureau of Entomology and Plant Quarantine has a total personnel of 53. Of these 27 are taxonomic specialists, one is a specialist in morphology, and the remainder are preparators, cataloguers, clerks and artists. Most of the specialists have space at the National Museum, and there is a very close cooperative relationship with that agency. Headquarters of the Division, however, are in the South Building of the Department of Agriculture. Identification and other service activities comprise the primary functions of this unit, but because of the inadequacy of existing knowledge of insect classification, a serious effort is being made to devote as much time as possible to research with the object of improving the quality of this service work. (Author's abstract.)

2. The National Collections of Insects.—E. A. Chapin.

The history and present status of the National Collection of Insects were discussed. The accumulation of economic insects brought to Washington by Dr. C. V. Riley, some 115,000 specimens, was the basis upon which the present collection of more than 5,000,000 specimens is built. The average annual increase in the number of specimens of 100,000 has come about mainly by virtue of gifts of private collections, but in part from specimens sent in for identification. Most of the curatorial work has of necessity fallen on the taxonomists of the Bureau of Entomology and Plant Quarantine because of the small Museum staff. By virtue of the fine cooperation which exists between the two organizations it is felt that much is accomplished even though the conditions for work are unsatisfactory because of crowding. (Author's abstract.)

3. Aids to the Taxonomist.—R. A. Cushman.

Mr. Cushman stated that the taxonomist of the Bureau of Entomology and Plant Quarantine is expected to identify not only adult insects but also fragments

and immature stages. He discussed the importance to the taxonomist of properly identified collections and adequate libraries, stating that the taxonomists of the Bureau are exceptionally fortunate in having access to the collections of the National Museum and to the many libraries in Washington. He described the ideal catalogue and discussed briefly the published catalogues, stating that all are far behind the literature and that world catalogues are entirely lacking in many of the orders of insects. Mr. Cushman went into some detail as to the method of cataloging current literature, especially the bibliographic work of Miss Catherine Ford. He stated that the cataloging force is far from adequate for the needs of the Division. In conclusion he called attention to the importance in relation to speed and accuracy of identification of full and accurate data and biological material such as immature stages or their exuviae associated with adult specimens. (Author's abstract.)

4. Taxonomic Research by the Individual Specialist.—Alan Stone.

Dr. Stone discussed the work of the individual taxonomist, with particular emphasis on research as it enteres into the routine service activities. The major research problems and methods used in such work were considered and the value to the Division of giving assistance to outside taxonomists was pointed out. (Author's abstract.)

5. Immature Stages as Involved in Insect Classification.—Carl Heinrich.

Mr. Heinrich stressed the fact that the function of the Division as a service organization imposes upon the workers, as individual taxonomists, the obligation of identifying insects in all stages. This can not be done satisfactorily, partly because the supply of determined material of immature stages is inadequate and partly because the systems of classification in the holometabolous orders are based almost exclusively upon selected characters of the adult stages alone. If taxonomy is to serve the interest of applied science we must have classifications conforming more closely to the facts of nature and based upon all available characters of the several stages, coordinating adult structure and habitus with larval and pupal structures, with egg shape and sculpture, and with biology and host relationship. The first step toward this end is the assembling and study of immature specimens that have been associated with adults. In this connection Mr. Heinrich gave a statement of the number of species, genera and families of Coleoptera, Lepidoptera, Diptera and Hymenoptera represented by larvae and pupae in the National Collection. Its collections of immature stages, while imposing as compared with those of other institutions are still far short of our needs or of the number of described species in any of the four major orders of Holometabola.

He indicated some of the immediate needs and a few of the first steps that should be taken to secure a "natural classification." (Author's abstract.)

Interesting comments followed by Lee A. Strong, S. A. Rohwer and A. S. Hoyt. Ewing and Cushman briefly discussed the matter of preparation of specimens intended for study. Muesebeck described the meeting rooms of the Entomological Society of London, which he visited during his recent trip to Europe, and several points of interest concerning that society.

Adjournment at 9.55 p. m.

Ashley B. Gurney,
Recording Secretary.

Actual date of publication, November 23, 1938.

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A NEW SPECIES OF HAEMAGOGUS, MESODENTATUS, FROM COSTA RICA, AND A DESCRIPTION OF THE LARVA OF HAEMAGOGUS ANASTASIONIS DYAR (DIPTERA, CULICIDAE).

By W. H. W. KOMP AND H. W. KUMM.[1]

During the course of a mosquito survey being conducted in the Republic of Costa Rica by the junior author, the larvae of a new species of *Haemagogus* were found in the water in a tree-hole in the Parque Bolivar, in San Jose, Costa Rica. A series of adults, males and females, were reared, and the associated larval skins were preserved. A description of the new species was drawn up from this material.

In the course of the same survey, *Haemagogus* larvae were found in the holy-water font of a church in Santa Cruz, province of Guanacaste, C. R. Males reared from these larvae showed that the species was *H. anastasionis* Dyar. As the larvae of this species have not been described, a description is here given.

DESCRIPTION OF ADULT FEMALE OF **Haemagogus mesodentatus**, n. sp. (HERE DESCRIBED.)

Head elongate, somewhat flattened dorso-ventrally.

Proboscis moderate, blue-black.

Palpi short, about one-sixth the length of the proboscis.

Antennae with tori black, with a few black setae.

Clypeus prominent, black, nude.

Vertex and occiput with blue-black scales; several long, strong setae projecting between the eyes; a narrow rim of white scales and several long black setae on dorsal margin of eyes; lower third of sides of head silvery white.

[1] This paper, and subsequent articles which it is hoped to publish, are the products of the collaboration of two colleagues. The order of the names of the authors of the new species herein described is of no significance as regards seniority. In the next paper of the series, the names of the authors will be reversed in order of precedence. The "senior" author of this paper is Senior Sanitary Engineer, U. S. Public Health Service, and the "junior" author is a staff member of the International Health Division of the Rockefeller Foundation.

The studies and observations on which this paper is based were conducted with the support and under the auspices of the United States Public Health Service, the International Health Division of the Rockefeller Foundation, and the Gorgas Memorial Laboratory.

Anterior pronotum (prothoracic lobe) with blue-black scales and a few strong black setae dorsally. Proepisternum with silvery white scales.

Mesonotum of thorax clothed with overlapping elongate scales having golden and purple reflections in certain lights; a few white scales just before wing-bases. Scutellum trilobed, heavily clothed with projecting scales and many long, strong setae from each lobe. A line of closely spaced, long, strong setae above each wing-root, extending posteriorly towards scutellum. Pleura with sternopleuron sparsely covered with grayish white scales. Epimeron with silvery white scales. Setae present as follows: many short black setae on each side of anterior promontory of mesonotum, just dorsal to prothoracic lobes. Prespiracular setae present; one lower sternopleural seta; a few prealar setae; a patch of upper mesipimeral setae.

Halteres with stem dusky, knob black.

Postnotum black, shining, without setae.

Abdomen long, slender, tapering, exceeding the length of the wing. First abdominal segment with black setae projecting from posterior margin; sides with silvery white scales. Remainder of segments without setae, but clothed with metallic bluish scales on tergites. A small spot of silvery white scales laterally, on sixth tergite. Sternites usually concealed, except the seventh and eighth. Tergites with silvery white scales laterally on first four segments, the colors separated in a straight line; on the fifth sternite the edges are dark, with a white median incision. Cerci dark.

Legs bright metallic blue-black. Fore femur without white ventrally. Mid femur narrowly white-lined internally. Hind femur broadly white on ventral aspect nearly to tip. Apical half of first mid-tarsal segment, basal half of second, and sometimes the base of third, clothed with grayish white scales. Remainder of tarsi, and the tibiae, dark blue-black. Claws on fore and mid tarsi toothed; without teeth on hind tarsi.

Wings moderate, hyaline, clothed with narrow black scales on veins, denser on costa and first and second veins.

Description of Male Terminalia of **Haemagogus mesodentatus**, n. sp.

Side-piece long, narrow, compressed; basal lobe small, rounded, projecting, with many fine setae, and a few much longer, flattened, tapering filaments, half as long as side-piece. Scales on inner distal margin of side-piece dense, alike, long, striate, broadly obovate, with very short pointed tips. No apical lobe, but a few long, curved setae just before tip of side-piece, on inner aspect. Outer aspect clothed with dense, long, striate, truncate-tipped scales, and long strong setae.

Clasper moderate, somewhat more than one-third the length of the side-piece, curved and somewhat enlarged at the middle. Terminal spine slightly subapical, slender, slightly swollen on basal third, curved and tapering beyond to a blunt point; spine about one-third as long as the clasper. Claspette with stem long, slightly sinuate in front view; in side-view, the outer third is bent at an angle of about 180 degrees with the stem; base somewhat swollen, then constricted before tbe angulation; a single strong seta on inner aspect, then

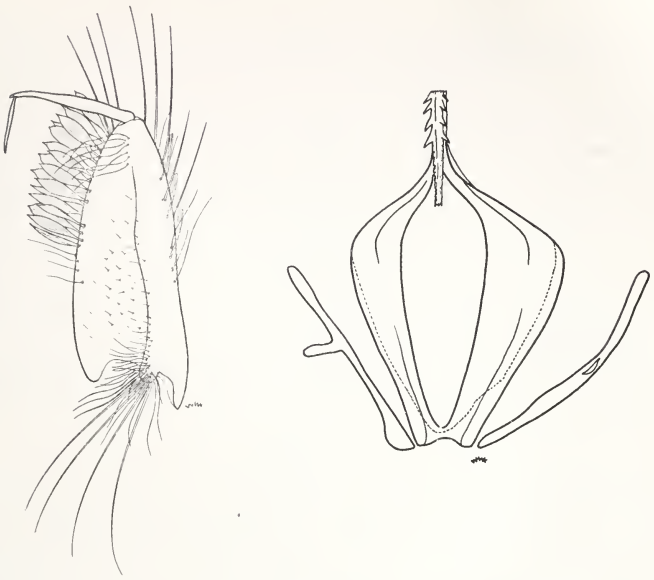


Fig. 1. *Haemogogus mesodentatus*, side piece and clasper of male.
Fig. 2. Mesosome of male of same, from a somewhat lateral aspect.

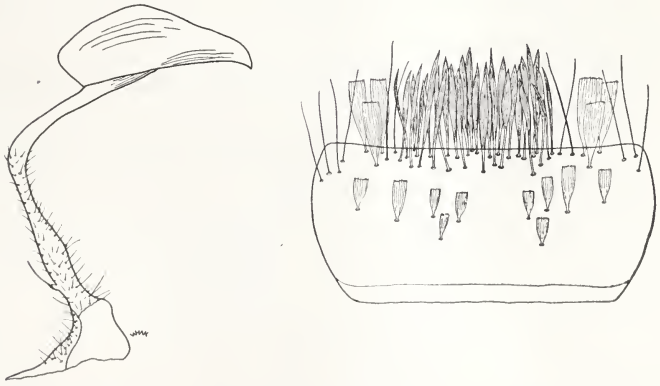


Fig. 3. *Haemogogus mesodentatus*, claspette and filament of male.
Fig. 4. *H. mesodentatus*, specialized scales on eighth abdominal tergite of male.

densely setose to angulation of stem, remainder bare to insertion of filament. Claspette filament in side-view a broad thin blade, nearly a half-circle in outline, striate, with a very small recurved tip.

Mesosome large, heavily chitinized, narrow at base, broadened into conspicuous shoulders distally, then tapering abruptly to a long, thin beak, with a slight tilt backwards; the tip of the beak forms a median carina, with about eight paired, coarse, curved serrations apically, and a number of finer ones basally. Body of mesosome with a large elliptical opening on dorsal face, into which the base of the median carina projects. Ventral face of mesosome widely open nearly to base.

Tenth sternites moderate, the tips chitinized, forming short, striate, oblique, hood-like structures, the outer angles projecting. Each sternite with 4 or 5 strong setae on outer aspect, below tip.

Ninth tergites poorly developed, but bearing one large curved seta apiece.

Eighth tergite bearing a patch of about 25 long, striate, obovate-lanceolate scales, two or three rows deep.

Type locality, San Jose, Costa Rica.

Type material, Holotype, male, allotype female, and 3 paratypes. To be deposited in the U. S. National Museum.

Type material reared from larvae found in a tree-hole in the Parque Bolivar, San Jose, Costa Rica, December 20, 1937, by Henry W. Kumm.

Description of Larva of **Haemagogus mesodentatus,** n. sp.

Head rounded, the head-hairs well forward on the fronto-clypeus. Anterior and posterior head-hairs single; intermediate tufts long, in tufts of 6 or 7. Anteantennal tuft in 3 or 4. Antenna relatively short, scarcely tapering, with a single hair just beyond middle.

Integument of thorax and abdomen finely long-pilose.

Lateral scale-patch of eighth abdominal segment of about 10 long, pointed scales, not fringed at tip.

Siphon stout, about 3 to 3½ times as long as wide, with 12 to 15 very closely spaced spines, closely followed by a 2-haired tuft at apical third of siphon. Spines short, with a single tooth at base.

Anal segment with chitinous saddle large, extending well down sides. Posterior margin with about 6 very large spicules. Lateral hair double, long, strong. Ventral brush small, of about 10 bifid hairs. Two long simple caudal hairs, and a pair of 3-haired tufts.

Anal gills short, rounded, about as long as anal segment.

Remarks: *H. mesodentatus* is apparently closely related to *H. janthinomys* Dyar, of South America. The claws of the female are toothed in both species. The integument of the larva is pilose, as in *janthinomys*, but the pilosity of *mesodentatus* is much finer and sparser than that of *janthinomys*. The scales on

Haemagogus mesodentatus n. sp.



Fig. 5. Details of larva of *Haemagogus mesodentatus*, N. Sp.

Haemagogus anastasionis Dyar

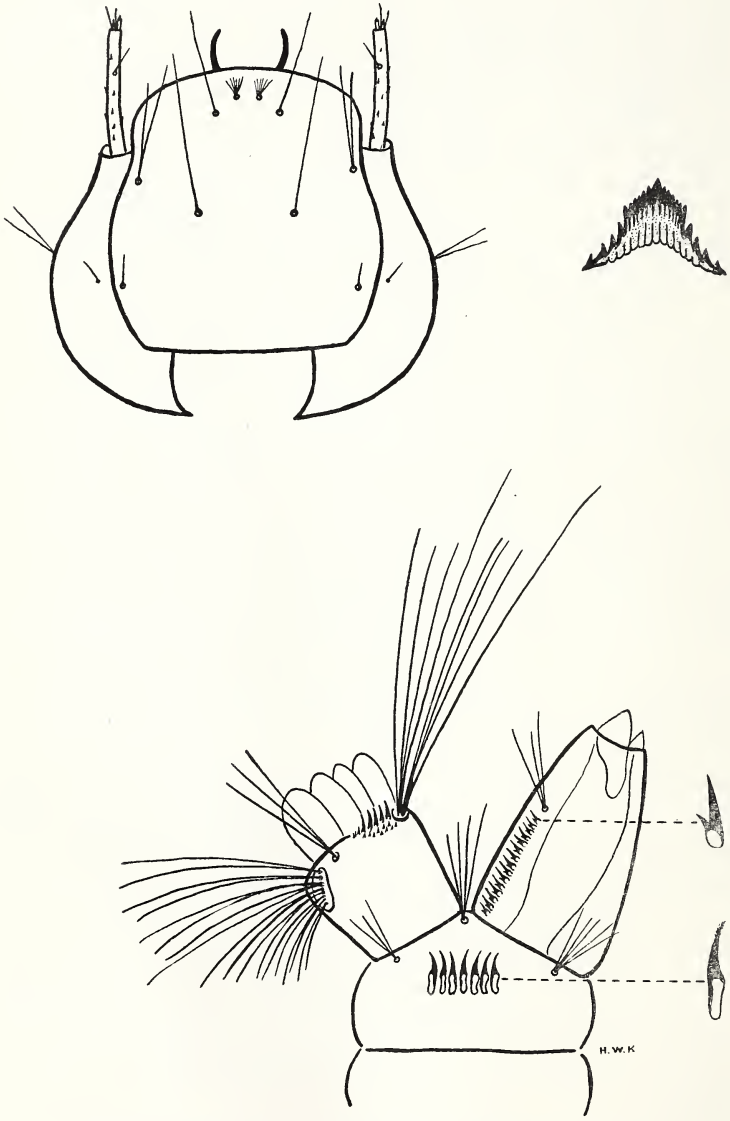


Fig. 6. Details of larva of *Haemagogus anastasionis* Dyar.

the eighth abdominal segment of *mesodentatus* larvae are free, but are attached to a plate in *janthinomys*. The appearance of the tip of the mesosome is similar in both species, but in *janthinomys* the tip is beaked, and the serrations are on the ventral surface, while in *mesodentatus* the tip is somewhat truncate, and the serrations are on a median carina on the dorsal surface. The filament of the claspette of *mesodentatus* is much wider than that of *janthinomys*, and the angle which the posterior outline makes with the stem of the claspette is much more obtuse than in *janthinomys*. In the adult female, the peculiar character of the grayish white scales on some of the mid-tarsal segments, if it is constant, should be a good distinguishing character.

Description of Larva of **Haemagogus anastasionis** Dyar.

Head rounded, the head-hairs well forward on the fronto-clypeus. Anterior and posterior head-hairs single, the anterior hairs somewhat closer together than the posterior hairs. Intermediate tufts long, in 5 or 6. Anteantennal tuft long, strong, in 2 or 3.

Antenna moderate, slightly tapering, smooth, with a 1- or 2-haired tuft just beyond middle.

Integument of thorax and abdomen glabrous.

Lateral scale-patch of 8th abdominal segment of 6 to 10 scales; each scale very long, slender, sharply pointed, with the tip very finely fringed (visible at 400 X magnification), curved, slender, somewhat longer than the base.

Siphon stout, slightly tapering, with 12 to 16 closely spaced spines, reaching middle of siphon, closely followed by a long 2- or 3-haired tuft; each spine short, with a short tooth near base; a few spines may have a number of teeth on inner aspect, between large tooth and base of spine.

Anal segment with chitinous saddle large, extending well down sides; posterior margin with 6 or 7 very stout, long spicules. Lateral hair in 3 or 4, long, slender. Ventral brush of about 10 hairs, not extending beyond barred area, the most dorsal hair in 4 or 5, the most ventral double or triple. Two long simple caudal hairs, and a pair of 3- or 4-haired tufts. Anal gills short, rounded, unequal, the ventral pair half the length of the dorsal pair.

Remarks: The larvae were found in a holy-water font in a church at Santa Cruz, province of Guanacaste, Costa Rica, December 20, 1937. Dr. H. W. Kumm, collector. Adult males and females were reared from these larvae, which correspond to the published description of this species, and with the original material from Costa Rica now in the U. S.

AEDES LEUCOTAENIATUS, A NEW SPECIES OF AEDES ALLIED TO A. LEUCOCELAENUS D. & S.; AND DESCRIPTIONS OF THE MALE AND LARVA OF A. LEUCOCELAENUS D. & S. (DIPTERA, CULICIDAE.)

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The renewed interest in various species of neotropical mosquitoes, in their roles as possible vectors of "jungle" yellow fever in South America, has recently been enhanced by the publication of a short note in "Science" (1) in which it is noted that several species, hitherto not incriminated, have been found infected in nature with the virus of yellow fever.

One of the species listed as transmitting the disease by its bite is *Aedes leucocelaenus* Dyar & Shannon.

This species was described by Lutz in 1904 (2), from females only, under the name *leucomelas*. The type localities were the States of Sao Paulo and Rio de Janeiro, Brazil. The name *leucomelas* being preoccupied, Dyar and Shannon proposed the name *leucocelaenus* in 1924 (3). No description of the larva or of the male terminalia of *leucocelaenus* exists in the literature, with the exception of a short description of the larva by Shannon (4), taken from a photomicrograph by da Costa Lima (5).

Dyar's (6) description and figure of the male terminalia of "*leucocelaenus*" were taken from material collected in the Panama Canal Zone. As the adults are indistinguishable on colorational characters, he assumed that the true *leucocelaenus* from Brazil and the Panama specimens were the same. Comparison of the Panama material in the U. S. National Museum, together with fresh material from Panama, with the male terminalia of specimens from Brazil, Argentina, Colombia, and British Guiana, shows that two distinct species are involved. The Panama material represents a hitherto unnamed species, for which the writer proposes the name *leucotaeniatus*. The material from South America is apparently all alike, and is the true *leucocelaenus* of Dyar and Shannon (*leucomelas* Lutz), the types of which came from Brazil.

Several marked differences have been noted in the male terminalia of the two species. The most striking of these differences is found in the shape of the filament of the claspette. The chaetotaxy of the side-piece is also quite different. A third difference is in the peculiar elongation of the ninth tergites of the Panama species, *leucotaeniatus*, which is absent in *leucocelaenus*.

[1] From the Gorgas Memorial Laboratory, Panama City, Rep. de Panama. Dr. H. C. Clark, Director.

These differences are well marked, as may be seen in the figures of the parts included in this paper.

In *leucocelaenus*, the stem of the claspette is more swollen than in *leucotaeniatus;* there are two or three very long, slender setae on the stem, their bases widely separated; the filament of the claspette is a long, curved, slender, flat blade, widest at the middle, and evenly curved to a sharp point. In *leucotaeniatus*, the stem of the claspette is more slender, and bears on its apical third inwardly two stout setae, inserted at the same level, and closely approximated; the filament of the claspette is shorter, and has a broad flat top, with a retrose point projecting in the opposite direction from the main blade.

The side-piece of *leucocelaenus* is much less hairy than that of *leucotaeniatus* from Panama, and the arrangement of the setae differs. In *leucocelaenus*, a number of long, slender, curved setae arise from prominent tubercles on the inner aspect, just below the apex. In *leucotaeniatus* from Panama, this area has a patch of dense, fine, short setae. The inner basal curve of the side-piece of *leucocelaenus* has a few sparse long setae. In *leucotaeniatus*, there is in this position a large, conspicuous patch of long fine setae, extending well up towards the apex. The area of the basal lobe is quite similar in both species, but the tubercles from which the setae arise are more prominent in *leucotaeniatus*.

The ninth tergite of the true *leucocelaenus* is undeveloped, without setae, being represented by a small chitinized ridge at the base of the tenth sternites. In *leucotaeniatus*, the ninth tergite bears two more or less triangular, flattened lobes, densely covered with fine microtrichia.

It is believed that these differences are sufficient to indicate that two distinct species occur, inseparable so far as gross adult characters are concerned, but easily separable by the characters of the male terminalia.

Description of **Aedes leucotaeniatus** n. sp. (Here described.)

Adult female: Proboscis very long and slender, blue-black. Palpi short, about one-sixth the length of the proboscis, clothed with long flat blue-black scales. Clypeus wider than long, black, shining, nude. Antenna with torus black, with a few short, curved, black setae; flagellar segments with whorls of long black hairs at joints. Vertex with a median line of elongate, flat, silvery-white scales extending to clypeus anteriorly, and continuing posteriorly on to occiput; a few strong black setae project forward over clypeus. Occiput clothed with silvery-white scales centrally, the sides with flat bluish-black scales; posteriorly an area of erect black fork-tipped scales. Eye-margins narrowly white-scaled above, with a few black setae; lower third of head white-scaled.

Thorax with mesonotum densely clothed with dull metallic blue scales; a narrow median line of silvery-white scales extending from anterior promontory to antescutellar space. Anterior pronotum (prothoracic lobe) with dorsal angle

black, remainder clothed with silvery-white scales, and a few strong black setae. Posterior pronotum ("proepimeron") clothed with silvery-white scales. A large patch of silvery-white scales before wing-root. Scutellum trilobed, clothed with flat blue-black scales and long black setae. Pleura with sternopleuron nude, black on anterior portion; posterior portion clothed with silvery-white scales, which join with those on anterior pronotum above to form a white line. Epimeron with a similar patch of white scales extending dorsally over the prealar area and joining those at base of wing-root to form a second white line. Setae as follows: many curved black setae just below anterior promontory; prespiracular setae long, black, prominent; postspiracular setae more numerous, weaker; several sternopleural setae; prealar setae present; upper mesepimeral setae present.

Abdomen with tergites clothed with closely-appressed blue-black scales; a few white scales on posterior margin of sixth and seventh segments. Sides of first segment broadly white; all segments with oblique lateral white spots ventrally. Fifth, sixth and seventh sternites projecting ventrally, their apical margins with a few yellowish hairs.

Legs blue-black, the femora white-lined beneath, their tips very narrowly white; mid and hind femora with a white spot at middle, joined to the ventral

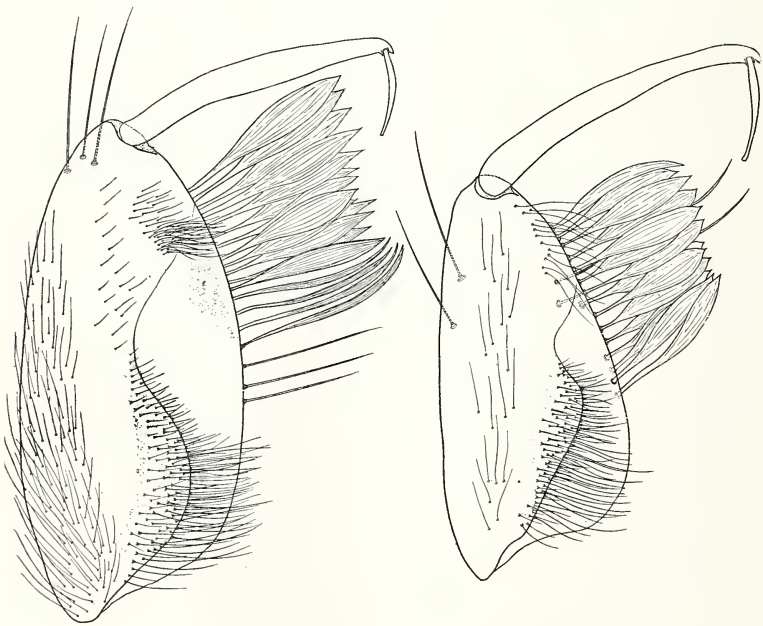


Fig. 1. Side-piece and clasper of *Aedes leucotaeniatus*, N. Sp.
Fig. 2. Side-piece and clasper of *Aedes leucocelaenus* D. & S.

Both figures to same scale.

white line. Tibiae and tarsi blue-black. Claws toothed on fore and mid tarsi, without teeth on hind tarsi.

Wings moderate, hyaline, clothed on the veins with elongate blue-black scales, somewhat more densely on costa and anterior veins.

DESCRIPTION OF MALE TERMINALIA OF **Aedes leucotaeniatus**, n. sp.

Side-piece rather short, not sharply tapering towards tip; inner distal margin with several rows of long, broadly lanceolate, striate scales and a few long setae. On inner aspect, just below apex, is a distinct area of long, slender, dense setae. Area of basal lobe clothed with many long setae from prominent tubercles. Dorso-lateral aspect of side-piece clothed with many very long, fine setae, extending well towards apex of side-piece. Clasper about half as long as side-piece, slightly enlarged centrally, tapering towards tip; terminal spine moderate, about one-third the length of the clasper, slightly swollen centrally, tapering to a blunt tip.

Claspette with slender sinuate stem, somewhat angled just beyond middle, densely clothed basally with fine setae; apical one-third of stem bare; two very stout, curved setae with bases closely approximated arise on inner aspect at apical third, their tips nearly reaching tip of filament; opposite these two setae and slightly below them, is a single much smaller seta. Filament of claspette broad, flat-topped, with a retrose point opposite the elongated, striate, sharp-pointed tip.

Tenth sternites large, erect, the tips recurved, hood-shaped, and striate; a few setae just below the tips.

Ninth tergite peculiarly elongated, forming two more or less triangular lobes with rounded tips, the whole surface covered with minute microtrichia.

Mesosome small, broad, somewhat narrower at base, slightly constricted just beyond middle, then widened before apex; tip with a small V-shaped excavation; dorsal face of mesosome with a low median ridge; dorsal basal opening small, nearly oval; ventral opening apical, small.

Holotype male, from Comacho, Panama Canal Zone, April 22, 1922 (J. B. Shropshire, collector). Male terminalia mounted on slide No. 1689. The slide is labeled *Haemagogus leucomelas* Lutz. Paratype male, from Comacho, Panama Canal Zone, April 22, 1922 (J. B. Shropshire, collector), the terminalia dissected and mounted on a modified Cobb mount. Allotype female, from Comacho, Panama Canal Zone, June 1, 1922 (J. B. Shropshire, collector). Also 5 females from Barro Colorado Island, Panama Canal Zone (R. C. Shannon, collector), July 8 and 9, 1923.

DESCRIPTION OF THE MALE TERMINALIA OF **Aedes leucocelaenus** D. & S.

Side-piece short, moderately tapering towards tip; inner distal margin with several rows of long, broadly lanceolate, striate scales and a few long setae. On inner aspect, just below tip, is an area with a few long curved setae from prom-

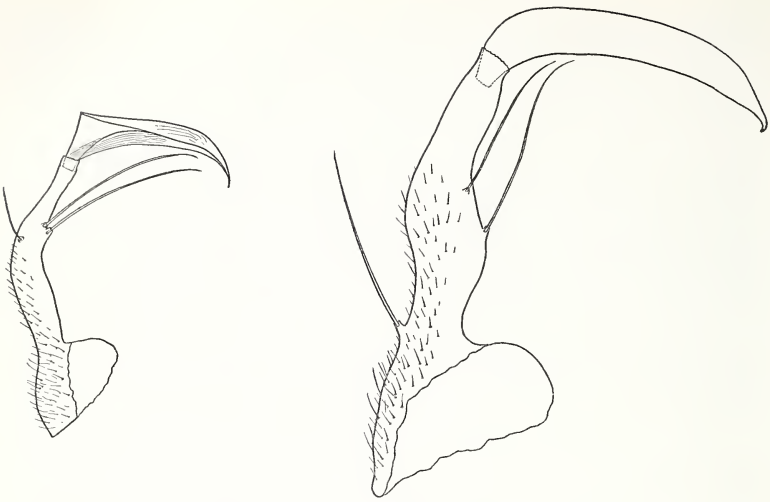


Fig. 3. Claspette and filament of *Aedes leucotaeniatus*, N. Sp.
Fig. 4. Claspette and filament of *Aedes leucocelaenus* D. & S.

Both figures to same scale.

inent tubercles, not forming a definite patch. Area of basal lobe covered with many long, stout setae from prominent tubercles. Dorso-lateral aspect of side-piece nearly bare, with only a few slender setae. Clasper long, slightly more than half the length of the side-piece, slightly enlarged centrally, tapering towards tip; terminal spine long, slender, slightly swollen centrally, tapering to a blunt tip; about one-third the length of the clasper.

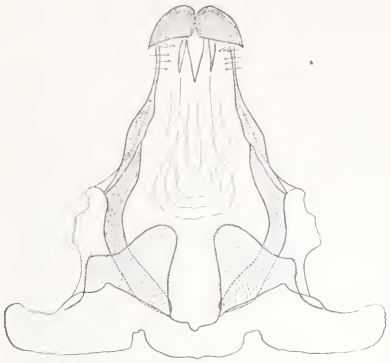
Claspette with a thick, sinuate stem, broad basally, tapering on distal third; base of stem clothed with fine setae, a very long, slender seta from a prominent tubercle just above base, on outer aspect; two long, slender, curved setae on inner aspect, their bases widely separated, their tips nearly reaching the filament of the claspette. Filament of claspette a long, curved, slender, flat blade, widest at the middle, evenly curved to a sharp point.

Tenth sternites moderate, erect, the tips recurved, hood-shaped, and striate; a few setae just below tips.

Ninth tergite undeveloped, without setae, being merely a narrow chitinized strip dorsal to base of tenth sternites.

Mesosome small, broad, somewhat narrower at base, slightly constricted just beyond middle, then widened before apex; tip with a small V-shaped excavation; dorsal face of mesosome with a low median ridge; dorsal basal opening small, nearly oval; ventral opening apical, small.

Described from the characters of three male specimens, one from Brazil, one from Argentina, and one from Colombia.



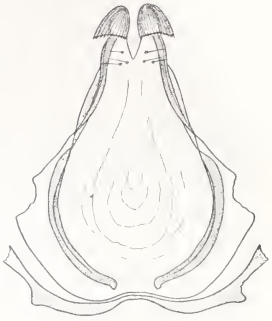


Fig. 5 Tenth sternites and ninth tergite of *Aedes leucotaeniatus*, N. Sp.
Fig. 6. Tenth sternites and ninth tergite of *Aedes ieucocelaenus* D. & S.

Both figures to same scale.

DESCRIPTION OF THE LARVA OF **Aedes leucocelaenus,** D. &.S.

The writer obtained larvae of this species at Restrepo, Colombia, and at Mazaruni, British Guiana. Males reared from these larvae had the terminalia as described for *leucocelaenus*. The larva of *leucotaeniatus* is still unknown.

Head: rounded, somewhat globular, widest between the eyes. Anterior head-hairs double, long, stout; intermediate head-hairs long multiple tufts, exceeding the anterior margin of the clypeus; their insertions are in line with the insertions of the anterior head-hairs. Posterior head-hairs usually triple (sometimes double), long, finer than the anterior head-hairs. Outer occipital hair a long, three- or four-haired tuft. Inner occipital hair long, single or double. Ante-antennal hair a long tuft of about 6 to 8 fine hairs.

Antenna long, slender, evenly tapering, the shaft sparsely spined with small spines; antennal hair single, at or beyond middle, extending to tip of antenna.

Thorax and abdomen with integument glabrous; secondary abdominal hairs in short, stiff, stellate tufts. Lateral abdominal hairs in three on first segment, in two on second to sixth segment, single on seventh segment. Comb of eighth segment of 5 or 6 moderate, sharp-pointed scales, curved like a cat's claw, not fringed at the tip.

Air-tube moderate, about three times as long as wide, slightly bulging at middle, tapering gently beyond; pecten of about 15 to 20 closely spaced spines, becoming progressively smaller from tip to base of tube; each spine a long tooth, with a few very small teeth at base. Pecten closely followed by a stout two-haired tuft, the hairs extending to tip of air-tube.

Anal segment cylindrical, not ringed by the plate. Plate large, extending well down sides of segment; dorsal posterior margin fringed with about 12 long spinules. Lateral hair long, double or triple. Ventral brush moderate, of about

8 paired tufts from the barred area; a few short single tufts ventrally, beyond barred area. A small triangular plate on each side of barred area. Inner submedian caudal hairs long, strong, simple; outer submedian caudal hairs triple, about two-thirds the length of the inner hairs.

Remarks. It should be stated that the palpi of the males of *Aedes leucotaeniatus* and *A. leucocelaenus* are long, slender, nearly as long as the proboscis.

In general the larva of *Aedes leucocelaenus* resembles those of the closely related species of *Haemagogus*. The comb of the eighth abdominal segment consists of a row of a few scales, as as in the larvae of *Haemagogus janthinomys*, *H. equinus*, *H. anastasionis*, and *H. mesodentatus*, N. sp. (7). It may be separated from the larvae of *janthinomys* by the smooth integument, as that of *janthinomys* is densely pilose; the scales of the eighth segment are more numerous, and on a plate, in *janthinomys*, while they are free in *leucocelaenus*. From *equinus*, it may be separated by the character of the posterisr head-hairs, which are single in *equinus*, and double or triple in *leucocelaenus;* the spines of the eighth abdominal segment in *equinus* are finely fringed, but are not fringed in *leucocelaenus*. The larva of *anastasionis* also has these spines finely fringed, and the posterior head-hairs are single. The larva of *mesodentatus* N. sp. has a finely pilose integument, and the anterior and posterior head-hairs are all single.

The larva of *leucocelaenus* is smaller and more slender than the larger, stockier larvae of the *Haemagogus* species, but this character is variable. All the species are addicted to water in tree-holes. However, *leucocelaenus* has been found only in South America, where *equinus*, *anastasionis* and *mesodentatus* have not yet been found to occur; in the faunal region in which *leucocelaenus* occurs, two yet unknown larvae, those of *albomaculatus* and *uriartei*, may resemble it; that of *janthinomys* is easily separable.

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MECOPTERA FROM CHINA, WITH DESCRIPTIONS OF NEW SPECIES.

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The Mecoptera which form the basis of the present paper were collected by D. C. Graham in Szechuan Province, China. The specimens were turned over to me by Professor Nathan Banks, to whom they had been sent for identification, along with a series of miscellaneous Neuroptera and Trichoptera, by the authorities of the National Museum. I am therefore indebted to Professor Banks not only for his usual helpful advice, but also for the opportunity to study this interesting material. The holotypes and allotypes of all new species are in the National Museum, but paratypes of certain species have also been deposited in the Museum of Comparative Zoology.

In my descriptions of these Chinese Mecoptera, all of which belong to the family Panorpidae, I have used the same terminology for the genitalia as employed in my revision of the Nearctic Mecoptera (Bull. Mus. Comp. Zool., 1931, 72, pp. 205–277), such as hypovalvae ("lower appendage"), preëpiproct ("upper appendage") and ventral valves ("tittilators") for the males, and subgenital plate and internal skeleton for the females. Unfortunately, detailed figures of the genitalia have not been given by the authors of most of the Chinese species of Mecoptera; until studies have been made of the genital structure of the types of described species, especially those of Navas, their specific classification will not be entirely clarified. Tjeder has recently (1935) taken a step in this direction by describing in detail the genitalia not only of some new material from China, but also of the type of one of Esben-Petersen's species.[1]

Since the literature pertaining to the Chinese Panorpidae is scattered in numerous publications, and especially since the list of these insects contained in the Catalogus Insectorum Sinensium (1937) is decidedly incomplete, I have included as an appendix to this paper an annotated list of the Panorpidae described from China.

Genus **PANORPA** Linn.

This genus, which is widely distributed over the northern hemisphere, has been represented in China by thirteen species, as indicated in the list below. These species readily fall into

[1] Tjeder states in his paper that only Farbotko (Trav. Soc. Scienc. Lettr. Vilno. Classe Sc. Math. Naturw. 5, p. 1–43) had previously used the female genitalia for the taxonomy of species, but he apparently overlooked my revision of the Nearctic Mecoptera (1931), in which the female genitalia of 25 species were described.

three categories, probably natural groups, depending upon the structure of the 6th abdominal segment of the male, i. e., whether the so-called anal horn is present, absent, or represented by two similar processes. In the first group, with a single anal horn, belong *centralis* Tjeder and *cornigera* McLachlan; in the second group, without the anal horn, belong *davidi* Navas, *stigmalis* Navas, *cladocerca* Navas, *tetrazonia* Navas, *waongkehzeni* Navas, *tincta* Navas, and *japonica* Thunberg; in the third group, with the double anal horn, belong *diceras* McLachlan, *tjederi* Carp. (new name for *diceras* Tjeder, *nec diceras* McLachlan), and *stotzneri* Esben-Petersen. One other species, *guttata* Navas, is known only from the female, so that its position in the above grouping is not determinable.

Panorpa flavipennis, n. sp.

Figures 3, 7, 12.

Body black, last few abdominal segments reddish brown; vertex entirely black; rostrum reddish brown. Fore wing: length, 13–14 mm.; width, 3 mm.; membrane deep yellow, markings grey; pterostigmal band usually complete or nearly so; basal band interrupted; apical band reduced to a few faint spots; both marginal and both basal spots absent; pterostigma dark red, very prominent; cross-veins not margined. Hind wing: similar to fore wings, except that basal band is entirely lacking. Single anal horn on 6th abdominal segment; 7th segment moderately incised above. ♂ genitalia: genital bulb rounded; forceps slender, with the outer margins slightly concave proximally, and a pair of longer lobes distally, the ventral lobe having a smoothly curved margin, the dorsal one an abruptly curved margin; hypovalvae very slender, almost reaching to the base of the forceps; ventral valves simple, each consisting of a single broad flat process bearing on its inner distal margin a number of distinct barbs; preëpiproct with curved sides and a moderately deep, U-shaped incision distally. ♀ genitalia: internal skeleton large, the axis extending beyond the plate for nearly half its length.

Holotype (♂).—U. S. N. M. No. 52857. Beh Luh Din, 30 miles north of Chengtu, Szechuan, China; Aug. 11, 1933, 6000 ft.; D. C. Graham.

Allotype.—Same collecting data as holotype except for date: Aug. 8, 1933; in U. S. N. M.

Paratypes.—Three females, with the same data as the holotype, except for the dates: Aug. 27, Aug. 4, Aug. 12; in the U. S. N. M. Also two females, same data with the dates July 12, Aug. 25; in the Museum of Comparative Zoology.

This species, possessing a single anal horn, falls into the group containing *centralis* Tjeder and *conigera* McLachlan. In both of the latter, however, the wing membrane is colorless or lacteous, whereas that of *flavipennis* is deep yellow. The male genitalia differ from those of *centralis* and *conigera* (the

type of which has been figured by Esben-Petersen, 1921) in the more slender hypovalvae and the possession of lobes on the forceps.

Panorpa curva, n. sp.

Figures 1, 8.

Body black, last few abdominal segments reddish brown; vertex with a transverse black band, enclosing the ocelli; rostrum light reddish brown. Fore wing: length, 7 mm.; width, 3 mm.; membrane hyaline, markings greyish brown; both marginal and both basal spots absent; basal, pterostigmal and apical bands complete, the last with a few interrupted spots; cross-veins not margined. Hind wing: similar to the fore. Anal horn absent. ♂ genitalia: genital bulb rather long; forceps small, the outer margins slightly concave near the middle, the apices abruptly curved; no true lobes present; at base of forceps there is a very prominent papilla bearing a number of black hairs and giving rise proximally to a large black spine; hypovalvae rather slender, not reaching to the base of the forceps; ventral valves simple, each consisting of a single stalk, which is distinctly twisted and bears distally a cluster of short barbs; preëpiproct slender, with nearly straight sides and a deep U-shaped distal incision.

♀ unknown.

Holotype (♂).—U. S. N. M. 52858. O-Er, 26 miles north of Li Fan, Szechuan, China; August 6, 1916, 9000 ft.; D. C. Graham.

This species, belonging to the group without the anal horn, resembles in wing markings *davidi* Navas, from Mou Pin, Tibet. The unique male type of *davidi* has been figured by Esben-Petersen, who shows distinctly two branches to each of the ventral valves. It is on the basis of this figure that I have determined the present specimen as representing a distinct species. There is a very slight chance that *curva* is identical with *cladocerca* Navas, from Kiang-si Province, but the ridiculous figure of the male genitalia given by Navas precludes any possibility of that species being recognized without examination of the type in the Heude Museum, Shanghai.

Panorpa difficilis, n. sp.

Figures 4, 6.

Body black, last few abdominal segments brown; vertex of head with a narrow transverse black band enclosing ocelli; rostrum light brown. Fore wing: length, 11 mm.; width, 3 mm.; membrane hyaline, markings greyish brown; apical band much broken, pterostigmal band broad but interrupted, basal band reduced to a small spot at the origin of Rs (in type); both marginal and both basal spots absent; cross-veins not margined. Hind wing: similar to the fore wing. Anal horn absent. ♂ genitalia: genital bulb rounded; forceps small, outer margins slightly concave, apices abruptly curved, no true lobes present; hypovalvae of moderate width, not reaching to the base of the forceps; ventral

valves simple, each consisting of a single stalk, broader distally than proximally, and with a cluster of barbs near the tip; the interior cavity of the genital bulb is unusually narrow; preëpiproct slender, with a deep U-shaped distal incision.

♀ unknown.

Holotype (♂).—U. S. N. M. 52859. Chengtu, Szechuan, China, 1936. D. C. Graham.

This species resembles the former superficially, but differs in the broader genital bulb and especially in the absence of the prominent papilla at the base of the forceps.

Panorpa diceras McLachlan.

Figures 2, 10, 11.

Panorpa diceras McLachlan, 1894, Ann. Mag. Nat. Hist. 13 : p. 423. (*nec P. diceras* Tjeder, 1935, Arkiv för Zoologi, 27A, No. 33: p. 7, pl. 4, 5, 7, fig. 4, 5).

In the present collection there are 15 specimens of Panorpa (3♂, 12♀) from the vicinity of Tachienlu, Szechuan, which fit McLachlan's description perfectly. Since Tachienlu is the type locality of *diceras*, I am led to conclude that these specimens belong to that species, although it is to be admitted that not until the genitalia of the type specimen (♂) have been examined can this identity be conclusively established. Tjeder has determined as belonging to his species a male and female from Yunnan Province, and has given detailed descriptions and figures of the genital structures. Obviously, Tjeder's specimens and those before me in the National Museum collection can not represent the same species, since the genitalia are very different. It should be noted, however, that Yunnan Province, where Tjeder's specimens were collected, is at least two hundred miles at its nearest point from Tachienlu, the locality at which the type of *diceras* and the National Museum specimens were collected. Even if both species fitted McLachlan's description equally well, the locality data alone would suggest that the latter specimens represented the true *diceras*. However, there seems to be one point contained in McLachlan's description which does not apply to Tjeder's specimens, but which does to the National Museum series. At the end of his description McLachlan states (1894, p. 424), "the whole cheliferous segment is more dusky in colour than those preceding it, and on its inner, or upper side if extended, is an appearance as of two long hairy processes, damaged in the individual before me." If I interpret the latter part of this sentence correctly,[2] McLachlan

[2] There is a slight possibility that the "two long yellow hairy processes" mentioned by McLachlan are really the cerci, which are beneath the preëpiproct, but this does not seem in the least probable.

has reference to the distal lobes of the preëpiproct, which is of course dorsal when the genital bulb is extended. In the male of Tjeder's species the lobes of the preëpiproct are almost absent, whereas in the National Museum species they are decidedly long. For these reasons, I consider it far more probable that the latter specimens, from the vicinity of Tachienlu, rather than Tjeder's, are the true *diceras*. Accordingly, I include here descriptions of the male and female genitalia of *diceras*, based upon the National Museum material, and also designate Tjeder's specimens as representatives of another species, *tjederi*.

The following description of the male genitalia of *diceras* is based upon a male taken at Omei, Szechuan, July, 1936, by D. C. Graham; Mt. Omei is about 100 miles from Tachienlu:

Genital bulb oval; forceps slender, outer margins smoothly curved, inner margins with two teeth, a small distal one and a long, slender proximal one; hypovalvae prominent, only very slightly broadened distally, reaching to the base of the forceps; ventral valves complex, consisting of a slender basal stalk, which gives rise to three branches, a small one on the inner side, a long middle branch, which extends well up between the forceps, and a shorter outer branch, which curves inwardly in back of (i. e., above) the second branch; preëpiproct broad, with long distal lobes.

The following description of the subgenital plate and the internal skeleton of the female is based upon a specimen collected near Tachienlu, 5000–8500 ft., June 18–July 12, 1923:

Posterior border of subgenital plate rounded; internal skeleton small, the axis very small, not projecting beyond the plate; plate attached to a chitinous, hood-shaped membrane, which extends slightly beyond the axis. It should be noted that this structure of the subgenital plate and of the internal skeleton is very similar to that of *stotzneri* Esben-Petersen (Tjeder, 1935, plate 6).

In addition to the specimens mentioned above, the following, all collected by D. C. Graham, have a similar genital structure: 1 ♂, 1 ♀ west of Yachow, Szechuan, 2000–7500 ft., June 14–18, 1922; 1 ♂, Suifu, Szechuan, Oct. 1, 1929; 1 ♀, near Tachienlu, Szechuan, 5000–8500 ft., June 18–July 12, 1923; 1 ♀, 30 miles north of Tachienlu, 12000 ft., July 5–9, 1923; 8 ♀, 9 miles southwest of Tachienlu, 9000–11000 ft., June 25–27, 1923.

Panorpa tjederi, n. n.

Panorpa diceras Tjeder, 1923, Arkiv för Zoologi, 27A, N:o 33 : p. 9, pl. 4, 5, 7, fig. 4, 5 (*nec diceras* McLachlan, 1894).

This species, which has been well described by Tjeder, resembles *diceras* and *stotzneri;* from the former (as treated here) it differs in the form of the forceps and the structure of the

ventral valves; from the latter it differs very obviously in the shape of the hypovalvae.

Holotype (♂) and allotype, from Yunnan Province, China (G. Forrest); in K. J. Morton collection.

Panorpa grahami, n. sp.

Figures 5, 9.

Body light brown; thorax and abdomen with a lateral black stripe; vertex of head with a black spot around ocelli; rostrum with black stripe on each side. Fore wing: length, 11 mm.; width, 3.5 mm.; membrane hyaline without markings except for a slight suspicion of grey at the apex. Hind wing: similar to the fore wing. Sixth abdominal segment with two short anal horns, as in *diceras*. ♂ genitalia: genital bulb rounded; forceps slender, the outer margin slightly concave at the middle, the inner margin with a small distal lobe and a larger pointed proximal lobe; hypovalvae reaching to base of forceps, narrowed proximally, much broadened distally, with rounded tips; ventral valves complex, consisting of a narrow basal stalk, which gives rise to three branches, pectinately arranged, the basal branch being the shortest, the others about equal; preëpiproct with prominent distal lobes, the incision being almost quadrate.

Holotype (♂).—U. S. N. M. 52860. 9 miles south of Tachienlu, Szechuan, China; 8500–13000 ft., June 25–27, 1923; D. C. Graham.

This species is closest in general appearance to *stotzneri* Esben-Petersen, from Kwanhsien and Wolung Kwan in Szechuan, 150 km. northeast of Tachienlu. Esben-Petersen's figure of the male type, however, shows that the hypovalvae, though broadened distally, are truncated and that the proximal lobe of the forceps is rounded, not pointed as in *grahami*. Unfortunately, his figure shows nothing of the structure of the ventral valves. The latter in *grahami* are somewhat like those of *tjederi;* but these two species are at once distinguished by the form of the hypovalvae.

Genus **NEOPANORPA** Weele.

This small genus has been found so far only in the southeastern part of continental Asia and certain of the East Indies. It has been represented in China by only five species, all described by Navas: *apicata*, *cavaleriei*, *dimidiata*, *lacunaris* and *pielina*.

Although the most obvious difference between Neopanorpa and Panorpa is the length of 1A, differences are also apparent in both male and female genitalia. In the male of Neopanorpa the hypovalvae are united further distally than in Panorpa and the ventral valves appear to be absent. The preëpiproct of Neopanorpa is likewise distinctive in being rounded distally, instead of incised, as is usual in Panorpa. In the females of

Neopanorpa the subgenital plate is distinctly emarginate distally, at least in all of the species which I have examined, though this emargination is diversely shaped in the different species. The internal skeleton of the 9th segment is small and in only one species known to me (*nigritis*, n. sp.) does the axis of the skeleton project beyond the plate.

Neopanorpa claripennis, n. sp.

Figures 21–24.

Body mostly black, last few abdominal segments reddish brown; vertex black; rostrum uniformly light brown, median process of third abdominal segment very short. Fore wing, length, 13 mm.; width, 3 mm.; wing membrane hyaline, slightly smoky, without color markings, although a few of the specimens have a very slight indication of grey distally; pterostigma large, dark grey, prominent. Hind wing similar to the fore. ♂ genitalia: genital bulb elongate; forceps slender, with a prominent lobe on the inner margin proximally; hypovalvae well developed, reaching to the base of the forceps, flattened apically and much broader distally than proximally. ♀ genitalia: subgenital plate broad, emarginate posteriorly, the incision being narrow; internal skeleton small, being U-shaped, the axis apparently entirely absent.

Holotype (♂).—U. S. N. M. 52861. Beh Luh Din, 30 miles north of Chengtu, Szechuan, China; July 28, 1923, 6000 ft.; D. C. Graham.

Allotype (♀).—Chengtu, Szechuan, China; 1936. D. C. Graham.

Paratypes.—1 ♂ Beh Luh Din, 30 miles north of Chengtu, Szechuan; Aug. 17, 1923, 6000 ft., D. C. Graham; 1 ♂, same locality, Aug. 8–10, 1933; 1 ♂, same locality, Aug. 8–19, 1933; 2 ♂ same locality, July 23, 1933; 1 ♂ same locality, July 28, 1933; 4 ♂, same locality, July 31, 1933; 2 ♂, same locality, Aug. 9, 1933; 1 ♂ same locality, Aug. 14, 1933; 1 ♂, same locality, Aug. 28, 1933; 1 ♂, same locality, Aug. 15, 1933. All of the foregoing paratypes are in the National Museum; the following paratypes are in the Museum of Comparative Zoology: 1 ♂, same locality as holotype, Aug. 16, 1933; 1 ♂, same locality, July 28, 1933; 2 ♂, same locality, Aug. 9, 1933; 1 ♂ same locality, Aug. 14, 1933; 1 ♂, same locality, Aug. 24, 1933; 1 ♀, Chengtu, 1936.

This species resembles *N. apicata* Navas, but differs, if I understand Navas' descriptions correctly, in several obvious respects. His figure of the tip of the wing shows a prominent darkening of the apex (hence the name *apicata*), and gives no indication of a prominent pterostigma. The wing of *claripennis* lacks the darkened apex and the pterostigma is made very prominent by its color. Unfortunately, according to Navas the

type of *apicata* (♂) lacks the terminal portion of the abdomen, so we shall never know the genital structure of the type.

Neopanorpa nigritis, n. sp.

Figures 17–20.

Body mostly black; entire abdomen including genital bulb, black, though the tip of the genital forceps is reddish brown; vertex black; rostrum light brown, but with a wide, median black stripe along the anterior surface. Median process of third abdominal tergite well developed, reaching almost to the anterior margin of the fourth segment. Fore wing: length 13 mm.; width, 2.5 mm.; wing membrane nearly hyaline, faintly smoky in appearance; no markings present; pterostigma well developed, reddish brown. ♂ genitalia: genital bulb slender, the forceps only of moderate length, with a small lobe proximally on the inner margin; hypovalvae slender, not quite reaching to the base of forceps, nearly membraneous distally, their tips bent slightly. ♀ like the male, with the entire abdomen black; ♀ genitalia: subgenital plate broad, with a V-shaped distal incision; internal skeleton with the axis projecting beyond the plate, the two posterior arms being well developed and reaching to the tips of the subgenital plate.

Holotype (♂).—U. S. N. M. 52862. Mt. Omei, Szechuan, China; July 19, 1936, 9000 ft.; D. C. Graham.

Allotype.—U. S. N. M.; same collecting data as holotype.

Paratypes.—1 ♀, same collecting data as holotype, in U. S. N. M. 1 ♂, Omei-Shan, W. China, 7000 ft., July 17, Rock; and 1 ♀, same collecting data as holotype; both in Museum of Comparative Zoology.

The wings of this species resemble those of *claripennis*, but the body color, especially the median stripe on the rostrum, enables its easy recognition. The internal skeleton of the ninth abdominal segment of the female is larger than that of any of the other species of Neopanorpa which I have seen, and it is the only one possessing a prominent axis.

Neopanorpa chelata, n. sp.

Figures 13–16.

Body brown and black; vertex black, rostrum light brown; thorax mostly brown, with a wide median dorsal black stripe; abdomen black above, the segments beyond the fifth reddish brown. Median process of the third abdominal segment prominent but not extending to the middle of the fourth segment. Fore wing: length, 14 mm.; width, 3 mm.; membrane hyaline, markings brown, apical band present but usually interrupted posteriorly; pterostigmal band entire, weak posteriorly; basal band reduced to only a few spots; hind wings similar to the fore. ♂ genitalia: genital bulb slender; forceps unusually long and slender, with a prominent proximal lobe on the inner margin; hypovalvae broad, especially distally each possessing an outer small apical lobe. ♀ genitalia: subgenital plate broad abruptly narrowed posteriorly, with a narrow

U-shaped incision distally; internal skeleton small, axis apparently absent, posterior arms short, forming a broad "U."

Holotype (♂).—U. S. N. M. 52863. Shinkaisi, Mt. Omei, Szechuan, China; Aug. 16–20, 1934.

Allotype.—In U. S. N. M. Same locality data as holotype.

Paratypes.—2 ♂, 2 ♀, Chengtu, Szechuan, 1936; 3 ♀, Shinkaisi, Mt. Omei, 4400 ft., Aug. 11–20, 1934; 1 ♀ Mt. Omei, 4000–6000 ft., Aug. 20–22, 1934. All of the foregoing paratypes are in the U. S. N. M.; the following paratypes are in the Museum of Comparative Zoology: 4 ♂, Chengtu, 1936, D. C. Graham; 1 ♀, foot of Washan, Szechuan, 6000–7000 ft., July 27, 1925. In the National Museum there is a broken specimen of this species, not a paratype, from Kuanshien, Szechuan, 1936.

This species resembles *cavaleriei* Navas, the type of which has been redescribed and figured by Esben-Petersen (1921, p. 83). However, according to the latter, the median process of the 3d abdominal segment of *cavaleriei* is narrow and long, almost reaching to the fifth segment. Since this process is short in the specimens before me, I conclude that we are dealing with another species. *N. chelata* also resembles *dimidiata* Navas, from Yunnan, but the apical band of the latter is better developed. The type of *dimidiata* being a unique female, the specific characteristics can not be determined for certain until the structure of the 9th abdominal segment has been studied.

Neopanorpa banksi, n. sp.

Figures 25, 26.

Body mostly black above; vertex black, last few abdominal segments brown, the others black above. Fore wing: length, 15 mm.; width, 3 mm.; membrane hyaline; markings brown; apical band entire, but narrowed posteriorly; pterostigmal band interrupted; basal band reduced to a few spots. ♀ genitalia: subgenital plate broad, with a wide U-shaped distal incision; internal skeleton large, the axis absent, but with three well-developed plates at the base of the long, posterior arms, which reach to the tip of the subgenital plate.

♂ unknown.

Holotype (♀).—U. S. N. M. 52864. Suifu, Szechuan, China; D. C. Graham.

Paratype.—1 ♀, with the collecting data of the type, in the Museum of Comparative Zoology.

This species resembles the former and *cavaleriei* in wing markings, though its apical band is stronger. It differs from *chelata* in the more elongate arms of the internal skeleton of the female. Although there is some possibility of its being identical with *cavaleriei*, I prefer to describe the species as new, with figures of the female genitalia, than to determine it questionably as Navas' species, the type of which came from another

Province, Kweichow (Kweivang). When the genital structure of the ♀ type of *cavaleriei* has been studied, this point will be definitely settled.

List of Chinese Panorpidae.

Genus **PANORPA** Linn.

Panorpa centralis Tjeder, Arkiv för Zoologie, 1935, 27A, N:o 33, p. 3, pl. 1, 2, 7, fig. 1, 2.
Type localities: ♂, Pao-ning-fu, N. E. Szechuan. ♀ Tjeggola, S. Kansu.
Type location: Stockholm Museum.

Panorpa cornigera McLachlan, Bull. Ent. Suisse, 1887, 7, p. 404. Esben-Petersen, Coll. Selys, 1921, 5 (2), p. 55, fig. 61–64. Issiki, Japan. Journ. Zool., 1933, 4, p. 4, fig. 7, 16. Tjeder, Arkiv för Zoologi, 27A, p. 7, pl. 3, 7 fig. 3 (describes and figures genitalia of ♀ type).
Type locality: ♂, ♀; Vladiwostok, Siberia.
Type location: Zurich Museum.

Panorpa flavipennis Carp., supra, p. 268.
Type locality: ♂, ♀, Beh Luh Din, near Chengtu, Szechuan.
Type location: U. S. N. M. and M. C. Z.

Panorpa davidi Navas, Mem. Real Acad. Cienc. Barc., 1908, p. 415, fig. 19a, b. Esben-Petersen, Coll. Selys, 1921, 5(2), p. 29, fig. 21–23.
Type locality: ♂, Mou Pin, Tibet.
Type location: Mus. Hist. Nat. Paris.

Panorpa stigmalis Navas, Mem. Real Acad. Cienc. Barc., 1908, p. 406, fig. 20. Esben-Petersen, Coll. Selys, 1921 5(2), p. 31, fig. 27–30.
Type locality: ♂, Mou Pin, Tibet.
Type location: Mus. Hist. Nat. Paris.

Panorpa cladocerca Navas, Notes Ent. Chin. Mus. Heude, 1935, 2(5) p. 95, fig. 59, 60.
Type locality: ♂, ♀, Kuling, Kiang-si.
Type location: Heude Museum, Shanghai.

Panorpa tetrazonia Navas, Notes d'Ent. Chin. Mus. Heude, 1935, 2(5), p. 96, fig. 61.
Type locality: ♂, Kuling, Kiang-si.
Type location: Heude Museum, Shanghai.

Panorpa waongkehzengi Navas, Notes d'Ent. Chin. Mus. Heude, 1935, 2(5), p. 98, fig. 62.
Type locality: ♂, ♀, Kuling, Kiang-si.
Type location: Heude Museum, Shanghai.

Panorpa tincta Navas, Rev. Acad. Cienc. Madrid, 1931, 26, p. 75, fig. 13.
Type locality: ♂, Hweisin, Kansu.
Type location: Hamburg Museum.

Panorpa japonica Thunberg, Nov. Ins. Sp. Dissert., 1784, 3, p. 67, fig. 9.
Type locality: Japan.
Type location: Zool. Mus. Univ. Upsala.
The extensive synonymy of this species is given in the Catalogus Insectorum Siensium, 1937, 3, p. 1264. All records are in Japan except for one

male specimen, which is the type of *leucothyria* Navas (Mem. Real Acad. Cienc. Barc., 1908, p. 414), from Tien-tseun, China (synonymized with *japonica* by Esben-Petersen).

Panorpa guttata Navas, Mem. Real Acad. Cienc. Barc., 1908, p. 45, fig. 19c. Esben-Petersen, Coll. Selys, 1921, 5(2), p. 32, fig. 32.
Type locality: ♀, Mou Pin, Tibet.
Type location: Mus. Hist. Nat. Paris.

Panorpa curva Carp., supra, p. 269.
Type locality: O-Er, Szechuan.
Type location: U. S. N. M.

Panorpa difficilis Carp., supra, p. 269.
Type locality: Chengtu, Szechuan.
Type location: U. S. N. M.

Panorpa diceras McLachlan, Ann. Mag. Nat. Hist., 1854, 13, p. 423.
Type locality: Tachienlu, Szechuan.
Type location: McLachlan collection.

Panorpa tjederi Carp., supra, p. 271 (=*P. diceras* Tjeder, *nec diceras* McLachl., Arkiv för Zoologi, 27A, No 33, p. 7, pl. 4, 5, 7, fig. 4, 5).
Type locality: ♂, ♀, Yunnan Province.
Type location: K. J. Morton collection, Edinburgh.

Panorpa stotzneri Esben-Petersen, Vidensk Medd. Dansk Naturh. Foren. 1934, 97, p. 211, fig. 1, 2.
Type locality: ♂, Kwanhsien, Szechuan; ♀, Wolung Kwan, 150 north east Tachienlu, Szechuan.
Type location: ♂, Staatl. Museen für Tier- und Völkerkunde, Dresden; ♀, Esben-Petersen collection, Silkeborg.

Panorpa grahami Carp., supra, p. 272.
Type locality: Tachienlu, Szechuan.
Type location: U. S. N. M.

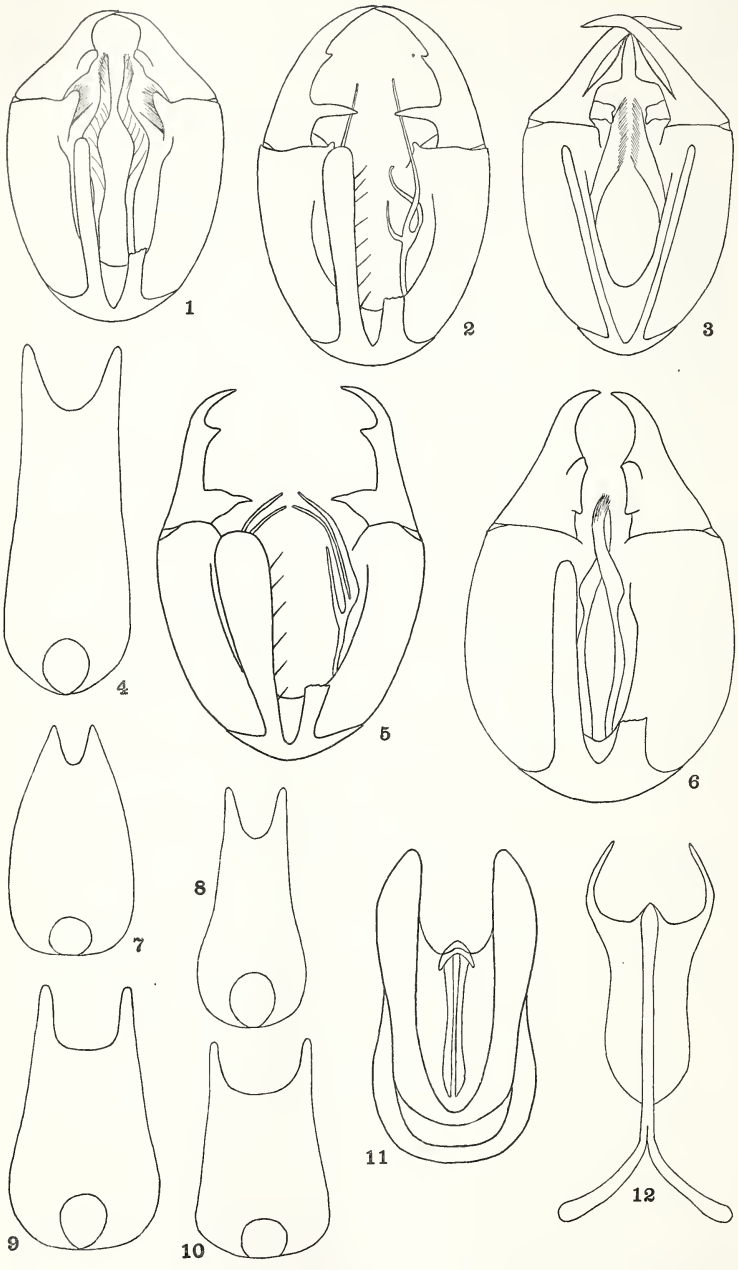
Genus **NEOPANORPA** Weele.

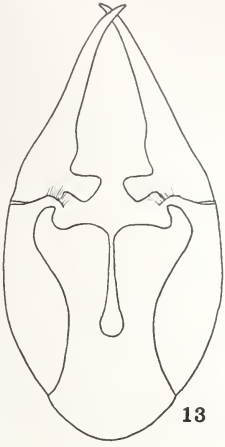
Neopanorpa apicata Navas, Rev. Acad. Cienc. Zaragosa, 1927, 7, p. 27, fig. 6.
Type locality: ♀, Kweichow.[3]
Type location: Mus. Hist. Nat. Paris.

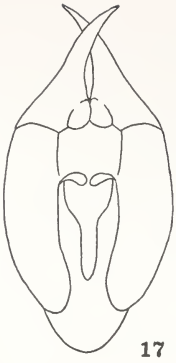
Neopanorpa caveleriei Navas, Mem. Real Acad. Cienc Barc., 1908, p. 417. Esben-Petersen, Coll. Selys, 1921, 5(2), p. 83, fig. 93, 94. Navas, Mem. Pont. Acad. Nouvi Lincei, 1926, 9, p. 920. Navas, Rev. Brot., 1930, 24(1), p. 13.
Type locality: ♂, Kweiyang, Kweichow.
Type location: Mus. Hist. Nat. Paris.

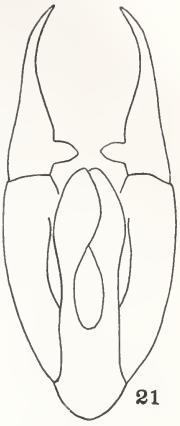
Neopanorpa dimidiata Navas, Notes d'Ent. Chin. Mus. Heude, 1930, 1(6), p. 2, fig. 1.
Type locality: ♀, Yunnan.
Type location: Heude Museum.

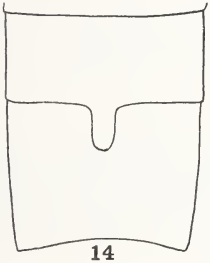
[3] The original description gives the locality as "Kouy-Tcheou," but that is obviously the French spelling used by Cavalerie, the collector, for Kweichow. I am indebted to Mr. Gaines Liu for this suggestion.

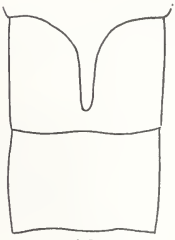

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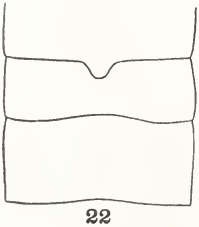

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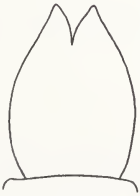

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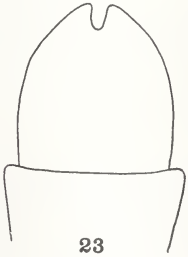

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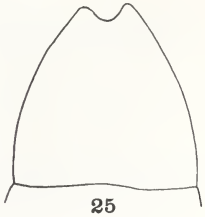

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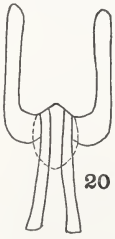

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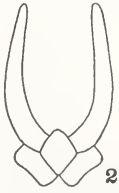

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Neopanorpa lacunaris Navas, Notes d'Chin. Mus. Heude, 1930, 1(6), p. 3, fig. 2.
Type locality: Yunnan.
Type location: Heude Museum.

Neopanorpa pielina Navas, Notes d'Ent. Mus. Heude, 3 (4), p. 58, fig. 72, 73.
Type locality: Kuling, Kiang-si.
Type location: Heude Museum.

Neopanorpa claripennis Carp., supra, p. 273.
Type localities: Beh Lu Din and Chengtu, Szechuan.
Type location: U. S. N. M. and M. C. Z.

Neopanorpa nigritis Carp., supra, p. 274.
Type locality: Mt. Omei, Szechuan.
Type location: U. S. N. M.

Neopanorpa chelata Car., supra, p. 274.
Type locality: Mt. Omei and Chengtu, Szechuan.
Type location: U. S. N. M. and M. C. Z.

Neopanorpa banksi Carp., supra, p. 275.
Type locality: Suifu, Szechuan.
Type location: U. S. N. M. and M. C. Z.

Neopanorpa (?) brisi (Navas), Notes d'Ent. Chin. Mus. Heude, 1930, 1(6), p. 4, fig.
Type locality: Yunnan.
Type location: Heude Museum, Shanghai.
This species was described by Navas in the genus Leptopanorpa, but his figure of the abdomen shows conclusively that it is not a member of that genus. It is probably a Neopanorpa, but may well belong to Panorpa.

Genus **LEPTOPANORPA** McLachlan.

Leptopanorpa javanica (Westwood), Trans. Ent. Soc. Lond., 1846, 4, p. 186. Esben-Petersen, Coll. Selys, 1921, 5(2), p. 89, fig. 100.
Type locality: Java.
Type location: British Museum.

Esben-Petersen records two females of this species in the British Museum from Mt. Wuchi, Hainan, China. So far as I am aware, this is the only record of the genus Leptopanorpa in China. In all probability, as Esben-Petersen apparently suspected, the Hainan specimens represent a different species.

Explanation of Figures.

Plate 23.

Fig. 1. Panorpa curva, n. sp., ventral view of ♂ genital bulb (holotype).
Fig. 2. Panorpa diceras McLachlan, ventral view of ♂ genital bulb.
Fig. 3. Panorpa flavipennis, n. sp., ventral view of ♂ genital bulb (holotype).
Fig. 4. Panorpa difficilis, n. sp., preëpiproct of ♂ (holotype).
Fig. 5. Panorpa grahami, n. sp., ventral view of ♂ genital bulb (holotype).

Fig. 6. Panorpa difficilis, n. sp., ventral view of ♂ genital bulb (holotype).
Fig. 7. Panorpa flavipennis, n. sp., preëpiproct of ♂ (holotype).
Fig. 8. Panorpa curva, n. sp., preëpiproct of ♂ (holotype).
Fig. 9. Panorpa grahami, n. sp., preëpiproct of ♂ (holotype).
Fig. 10. Panorpa difficilis, n. sp., preëpiproct of ♂ (holotype).
Fig. 11. Panorpa diceras McLachlan, internal skeleton of ♀.
Fig. 12. Panorpa flavipennis, n. sp., internal skeleton of ♀ (allotype).

PLATE 24.

Fig. 13. Neopanorpa chelata, n. sp., ventral view of ♂ genital bulb (holotype).
Fig. 14. Neopanorpa chelata, n. sp., dorsal view of 3d and 4th abdominal segments of ♂ (holotype).
Fig. 15. Neopanorpa chelata, n. sp., subgenital plate of ♀ (allotype).
Fig. 16. Neopanorpa chelata, n. sp., internal skeleton of ♀ (allotype).
Fig. 17. Neopanorpa nigritis, n. sp., ventral view of ♂ genital bulb (holotype).
Fig. 18. Neopanorpa nigritis, n. sp., dorsal view of 3d, 4th, and 5th abdominal segments of ♂ (holotype).
Fig. 19. Neopanorpa nigritis, n. sp., subgenital plate of ♀ (allotype).
Fig. 20. Neopanorpa nigritis, n. sp., internal skeleton of ♀ (allotype).
Fig. 21. Neopanorpa claripennis, n. sp., ventral view of ♂ genital bulb (holotype).
Fig. 22. Neopanorpa claripennis, n. sp., dorsal view of 3d, 4th, and 5th abdominal segments of ♂ (holotype).
Fig. 23. Neopanorpa claripennis, n. sp., subgenital plate of ♀ (allotype).
Fig. 24. Neopanorpa claripennis, n. sp., internal skeleton of ♂ (allotype).
Fig. 25. Neopanorpa banksi, n. sp., subgenital plate of ♀ (holotype).
Fig. 26. Neopanorpa banksi, n. sp., internal skeleton of ♀ (holotype).

THE GENUS DENDROSOTER WESMAEL IN THE UNITED STATES (HYMENOPTERA : BRACONIDAE).

By C. F. W. MUESEBECK,
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

Only one Nearctic species of *Dendrosoter* has been described. This is *scolytivorus* (Viereck and Rohwer), which has been known only from the two male specimens comprising the type material. Three additional, undescribed species have, however, been reared in the United States by investigators in the Bureau of Entomology and Plant Quarantine. All four species are said to be parasitic on the larvae of bark beetles (Scolytidae). The present synopsis is presented to facilitate their identification and to provide names for the new species.

DENDROSOTER Wesmael.

Dendrosoter Wesmael, Nouv. Mem. Acad. Sci., Bruxelles 9 : 137, 1838. Genotype, *Bracon protuberans* Nees.

Eurybolus Ratzeburg, Ichneumonen der Forstinsekten, vol, 2, p. 32, 1848. Genotype, (*Bracon curtisii* Ratz.) = *B. protuberans* Nees.

Caenopachys Foerster, Verh. Naturh. Ver. Preuss. Rheinlande 19 : 239, 1862. Genotype, *Bracon hartigii* Ratz.

Dendrosoter Picard, Bull. Soc. Zool. France 53 : 50–56, 1928.

Picard, in the paper cited above, definitely suppressed *Caenopachys* Foerster as a synonym of *Dendrosoter* by transferring its type, *Bracon hartigii* Ratzeburg, to the latter genus. With this action I fully concur.

When he described the genus Wesmael indicated that *Dendrosoter* falls between the Doryctinae and Spathiinae, resembling the former in the abdomen and the latter in the wings. Most investigators appear to have followed Foerster in assigning it to the subfamily Doryctinae, although Ashmead[1] placed it in the Spathiinae. Obviously the various subfamilies comprising the cyclostomine Braconidae require redefinition, with some realignment of the genera. This, however, demands a more thorough review of the entire group than has yet been undertaken. For the present, therefore, I believe the genus *Dendrosoter* is best retained in the Doryctinae. It may be briefly characterized as follows:

With a subcircular impression ("mouth-opening") between clypeus and mandibles; head subcubical; occiput sharply, completely margined and noticeably excavated; frons with two conspicuous protuberances that are transversely striate; antennae very slender; thorax compact; pronotum above strongly transverse; notaulices impressed at least anteriorly; prepectus margined; anterior wing with three cubital cells; recurrent vein entering second cubital cell; medius more or less sinuate; nervulus strongly postfurcal; subdiscoideus interstitial; posterior wing of male with a large stigma (according to Picard occasionally wanting in certain Old World species); coxae relatively small; calcaria of posterior tibiae short; abdomen sessile or subsessile; spiracle of first abdominal segment before middle; second and third tergites connate, their spiracles above the lateral margins; ovipositor prominent.

Key to Nearctic Species of Dendrosoter.

1. Radius arising basad of middle of stigma, its second and third abscissae arched so that radial cell is very narrow, much narrower than second cubital cell; stigma of male posterior wing shorter than distance from its base to base of wing ..... 1. *scolytivorus* (Viereck and Rohwer)

Radius arising from middle of stigma, or beyond, its second and third abscissae not arched; radial cell as wide as second cubital; stigma of male posterior wing longer than distance from its base to base of wing 2

[1] Ashmead, W. H. Proc. U. S. Nat. Mus. 23 : 148, 1900.

2. Abdomen smooth and polished beyond first tergite, at most with a few weak, short striae at base of connate second and third tergites each side of middle; notaulices obsolescent caudad; disk of scutellum much broader at base than long, the sulcus at its base unusually long ..... 2. *sulcatus*, new species

Connate second and third tergites sculptured on at least basal third; notaulices complete; disk of scutellum not broader at base than long, the sulcus at its base normal 3

3. Connate second and third tergites sculptured to beyond middle; scutellum strongly convex; last abscissa of cubitus usually shorter than second abscissa of radius; radial cell much more strongly infumated basally than apically ..... 3. *scaber*, new species

Sculpture of connate second and third tergites confined to a basal, more or less semicircular, area not extending to middle; disk of scutellum very weakly convex; last abscissa of cubitus at least as long as second abscissa of radius; radial cell uniformly infumated ..... 4. *integer*, new species

Dendrosoter scolytivorus (Viereck and Rohwer).

(Fig. 1, A).

Caenopachys scolytivora Viereck and Rohwer, Proc. U. S. Nat. Mus. 45 : 536, 1913.

Immediately distinguished from the other Nearctic species by the conspicuously modified wing venation. In this respect it is strikingly like the European *D. hartigii* (Ratz.), but it differs from that species in the much narrower radial cell and in having the second cubital cell decidedly longer than the third.

Male.—Malar space at least as long as eye; temple nearly twice as broad as eye width; cheek smooth below; maxillary palpus slender, normal; antenna 20-segmented; notaulices sharply impressed, complete, meeting before apex of mesoscutum; scutellum moderately convex; mesopleuron smooth apically; hind coxa almost entirely smooth; second and third abscissae of both radius and cubitus greatly thickened, radial cell strongly narrowed, second and third cubital cells correspondingly widened, and second intercubitus unusually long and oblique; stigma of posterior wing not so long as distance from its base to base of wing; first tergite striate, with a narrow, parallel-sided, smooth strip down middle; second and following tergites polished except for a little weak sculpture at base of second tergite each side of middle.

The above notes are based on the two males from Elmore, S. Dak., comprising the type series. The collection of the National Museum also contains one female labeled "Grand Canyon N. P., June 10, 1936, *Pinus ponderosa*, D. De Leon Coll.," which I believe belongs here. It agrees thoroughly with the male except in the secondary sexual differences characteristic

of certain species in this group, the radius and cubitus being slender although the radial and cubital cells are of the same form as in the male.

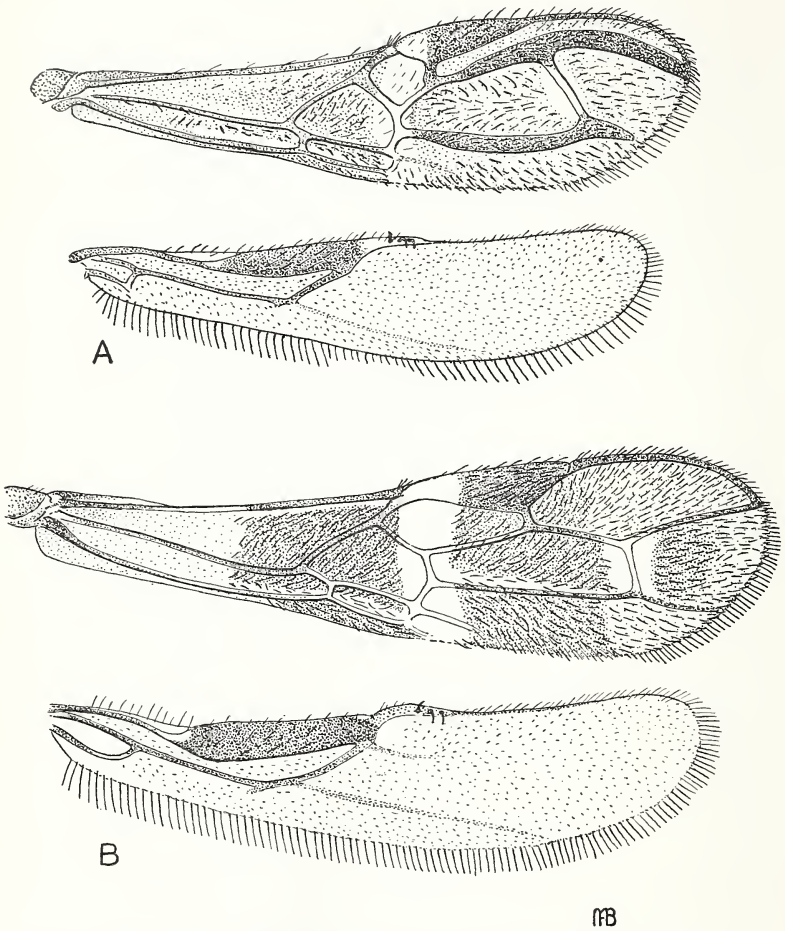


FIG. 1.—Anterior and posterior wings of: A, *Dendrosoter scolytivorus*, and B, *Dendrosoter scaber*. Drawn by Mary F. Benson.

Dendrosoter sulcatus, new species.

In sculpture this species is most like *scolytivorus* but it is readily distinguished by the differences mentioned in the key. In common with the two other new species, described below, it differs markedly from *scolytivorus* in the venation of the anterior

wing; and from all three it may be separated by its weak and incomplete notaulices.

Female.—Length 2.8 to 3.5 mm. Temple at narrowest point broader than eye height, very delicately sculptured; cheek below smooth and polished; ridges of frontal protuberances irregular and incomplete; malar space shorter than eye; antenna 19 to 23-segmented, basal flagellar segment slightly shorter than second; maxillary palpus shorter than height of head.

Mesoscutum very finely granular, not at all medially impressed before scutellum; notaulices not extending beyond an imaginary line joining bases of tegulae; transverse sulcus before scutellum unusually long, nearly as long as scutellum itself, and having numerous conspicuous longitudinal carinae; scutellum much broader at base than long, sculptured like mesoscutum; propodeum finely rugulose; mesopleuron aciculate or rugulose in the oblique impression, a small triangular area at anterior end, and a larger area behind, smooth and polished; metapleuron finely longitudinally aciculate; recurrent vein going well into second cubital cell; first intercubitus not more than two-thirds as long as second abscissa of radius, the latter on almost a straight line with the third abscissa and of about the same length; second cubital cell paralel-sided; third cubital cell widening only slightly toward apex; postnervellus very weak; posterior coxa smooth and shining.

First tergite closely, longitudinally aciculate; remainder of abdomen completely polished except for a little very faint sculpture at extreme base of fused second and third tergites on each side of the middle; ovipositor sheath slightly longer than abdomen.

Dark brown, irregularly varied with yellowish brown and piceous; apical half of abdomen conspicuously darker than basal half; fore wing infumated with the usual transverse hyaline band just beyond base and another much narrower band behind base of stigma; hind wing completely hyaline.

Male.—Except for secondary sexual differences essentially like the female; maxillary palpus normal, third segment not enlarged; stigma of posterior wing longer than distance from its base to base of wing.

Type.—U. S. National Museum No. 52997.

Type locality.—Tryon, N. C.

Hosts.—*Ips avulsus* Eich., *Dendroctonus frontalis* Dz. and *Ips* sp.

Described from the following material: Nine specimens, including type and allotype, reared from *Ips avulsus*, Tryon, N. C., 1906, W. F. Fiske, Hopk. U. S. No. 3700 C; 1 from *Dendroctonus frontalis*, Asheville, N. C., Sept. 6, 1925, F. C. Craighead, Hopk. U. S. No. 9931 f; 4 from *D. frontalis*, Tryon, N. C., 1903, W. F. Fiske, Hopk. U. S. No. 1653 c; 4 from same host and locality, June 3, 1903, W. F. Fiske, Hopk. U. S. No. 1574 f; 2 from *D. frontalis*, Asheville, N. C., Dec. 1927, Hopk. U. S. No. 10785 g; 6 recorded from *Ips* sp. in *Pinus rigida*, Falls Church, Va., July 13, 1916, T. E. Snyder, Hopk. U. S. No. 14068; 3 taken from galleries in pine, Glencarlyn, Va., Sept.,

1913, C. T. Greene, Hopk. U. S. No. 10449; 2 from galleries in longleaf pine, Call, Tex., 1905, W. F. Fiske, Hopk. U. S. No. 3442 v; 12 from *D. frontalis*, Asheville, N. C., July and October, 1925, A. H. McAndrews, and 3 from Washington, D. C., Sept. 20, 1911, W. Middleton.

Dendrosoter scaber, new species.

(Fig. 1, B.)

This may be distinguished from the other North American species by the more extensive sculpture of the abdomen, and the strongly convex scutellum.

Female.—Length 2.5 to 3.5 mm. Face closely rugulose; malar space, temple, and cheek finely granular; temple wider than eye height; malar space nearly as long as eye; ridges of frontal protuberances strong and complete; occiput granular and dull; antenna usually 24- to 26-segmented but with as few as 20 segments in a very small specimen; maxillary palpus hardly as long as height of head.

Mesoscutum closely granular, dull; notaulices complete, meeting in a shallow impression on posterior fourth of mesoscutum; scutellar sulcus only half as long as scutellum, the latter at least as long as broad at base, conspicuously elevated, and sculptured like mesoscutum; propodeum and metapleuron completely rugulose; side of pronotum rugulose; mesopleuron entirely closely sculptured, more coarsely so anteriorly, dull; recurrent vein entering second cubital cell and about as long as second abscissa of cubitus; first cubital cell twice as long as high; second abscissa of radius subequal to first intercubitus, and usually longer than either third abscissa of radius or third abscissa of cubitus, parallel with posterior side of second cubital cell; postnervellus well developed, strongly antefurcal; posterior coxa finely granular and dull, with some longitudinal aciculation.

First abdominal tergite strongly rugulose, the connate second and third tergites finely, longitudinally sculptured to beyond middle; ovipositor sheath about as long as abdomen or slightly longer.

Dark brown; frontal protuberances not contrastingly paler than rest of head; wings banded as in *sulcatus;* radial cell deeply infumated basally, very weakly so apically; apical third of abdomen piceous black.

Male.—In essential characters like the female; third segment of maxillary palpus not enlarged; stigma of posterior wing longer than distance from its base to base of wing; postnervellus only weakly indicated.

Type.—U. S. National Museum No. 52998.

Type locality.—Gasquet Ranger Station, Del Norte County, Calif.

Host.—Bark beetle in *Pseudotsuga taxifolia.*

Described from the following 24 specimens: Type, allotype, and 19 paratypes from the type locality, reared by R. L. Furniss, of the Bureau of Entomology and Plant Quarantine, in June, 1937, under Hopk. U. S. No. 31716 C; one paratype, likewise

reared by Mr. Furniss from a bark beetle in *Pseudotsuga taxifolia*, March 4, 1934, at Mt. St. Helena, Calif., Hopk. U. S. No. 21125 H, and two paratypes reared by F. P. Keen from *Pityophthorus* sp., in *Pinus monophylla*, at Big Bear, San Bernardino National Forest, Calif., under Hopk. U. S. No. 18137 J.

Dendrosoter integer, new species.

Most similar to the European *middendorffii* (Ratz.), but differing in its much shorter first abscissa of radius, which is only half as long as width of stigma, in the more extensive sculpturing of second tergite, and the finer sculpture of side of pronotum and of mesopleuron. Also very similar to *scaber*, from which it may be readily distinguished, however, by the characters mentioned in the key. It differs from the foregoing description of that species as follows:

Female.—Length 2.5 to 3.2 mm. Antenna 21- to 24-segmented in specimens examined; scutellum weakly convex, more than twice as long as the scutellar sulcus; second abscissa of radius a little longer than first intercubitus, shorter than third abscissa of radius, and not distinctly longer than last abscissa of cubitus; postnervellus interstitial, or nearly so; first abdominal tergite entirely, closely aciculate; connate second and third tergites at base with a rather sharply limited, more or less semicircular, finely aciculate area which does not extend nearly to middle. Radial cell uniformly infumated.

Male.—Similar to female in all important respects; stigma of posterior wing much longer than the distance from its base to base of wing and about one-third as long as wing.

Type.—U. S. National Museum No. 52999.

Type locality.—Pinehurst, Oreg.

Host.—Scolytidae in *Libocedrus decurrens*.

Described from the following 35 specimens: The type, allotype and 26 paratypes from the type locality, reared by W. J. Buckhorn of the Bureau of Entomology and Plant Quarantine, June 21, 1930, under Hopkins No. 18901; three paratypes labeled "*Phloeosinus* in *Libocedrus decurrens*, Klamath Falls, Ore., July 3, 1930"; one paratype reared from Monterey cypress infested with *Phloeosinus cristatus* Lec. at Palo Alto, Calif., by H. E. Burke; one paratype from *Scolytus praeceps* Lec. in *Abies concolor* at Pine Crest, Calif.; and one paratype each from Willow Ranch and Paradise Creek, Calif.

MINUTES OF THE 495TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 495th meeting of the Society was called to order by President Back at 8 P. M., Thursday, November 3, 1938, in Room 43 of the National Museum. Members and visitors present numbered 43 and 10, respectively. The minutes of the October meeting were read and approved.

The following individuals were unanimously elected to membership in the Society:

H. W. Capps, Division of Insect Identification, Bureau of Entomology and Plant Quarantine, Washington, D. C.

Lloyd E. Rozeboom, Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma.

D. J. Caffrey announced that the Society had been invited to send a representative to the 75th Anniversary Meeting of the Entomological Society of Ontario, to be held at Guelph, Ontario, November 24–25, 1938. It was voted that the matter of sending a delegate be left in the hands of the President.

The regular program consisted of a symposium on Insecticide Investigations and included the two following talks:

1. Organization and functions of the Division of Insecticide Investigations. —R. C. ROARK.

The Division does most of its work in Washington, D. C., although there are four field laboratories where work is carried on in close cooperation with the Division of Fruit Insect Investigations. These field laboratories are located at Moorestown, N. J., Vincennes, Ind., Whittier, Calif., and Yakima, Wash. There are eight projects, namely, chemical investigations on insecticidal plants, synthetic organic compounds, insecticidal deposits, inorganic insecticides, fumigants, accessory materials, studies to determine toxicity of materials using the goldfish, and analytical investigations. The work of this Division on pyrethrum, derris, tobacco and quassia was discussed. The development of synthetic organic compounds for testing as insecticides was also discussed. Secimens of natural and synthetic organic insecticides were exhibited. (Author's abstract.)

2. Some research problems of the Division of Insecticide Investigations. C. M. SMITH.

Discussion followed by McIndoo, Rohwer, Siegler and Back. Snodgrass commented briefly regarding the proposed sending of a delegate to the above mentioned meeting at Guelph, Ontario.

President Back announced the appointment of a committee to nominate candidates for the 1939 officers of the Society, consisting of R. A. Cushman, J. S. Wade, Carl Heinrich, E. C. Cushing and U. C. Loftin.

Several members of the Division of Insecticide Investigations were included among the visitors introduced to the Society.

Adjournment at 9.40 P. M.

ASHLEY B. GURNEY,
Recording Secretary.

Actual date of publication, December 30, 1938.

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